UNIVERSITAS SEBELAS MARET
FACULTY OF TEACHER TRAINING AND EDUCATION
BACHELOR OF BIOLOGY EDUCATION STUDY PROGRAM
Building D 3rd Floor FTTE UNS Jl Ir. Sutami No. 36 A Kentingan Surakarta 57126 Indonesia
E-mail: biologi@fkip.uns.ac.id; Website: https://biologi.fkip.uns.ac.id/en/

Module Name	Diversity and Classification of Phanerogamae (Keanekaragaman dan Klasifikasi Phanerogamae)
Module level	Undergraduate Programme
Course Code	02013143002
Abbreviation, if applicable	-
Courses included in the module, if applicable	-
Semester/Term	3rd
Module coordinator (s)	Dr. Muzzazinah., M.Si
Lecturer (s)	Dr. Muzzazinah., M.Si
Language	Bahasa Indonesia (Indonesian Language)
Classification within the Curriculum	Compulsory/~~Elective~~
Teaching format/class hours per week during the Semester	**Direct instruction/face to face/blended learning: 26.7 hours/ Week:** lecture, discussion, field study **Structured Activity: 32 hours / Week** (Through the case method with analysis of journal articles, students learn Biology information about Phanerogamae) **Self-study Activity: 32 hours / Week** (Students learn vertebrate classis from various sources) **Practicum in laboratory:** Laboratory activity: 10 topic/week x 170 minute = 1700 minutes Hour = 1700 minutes/60 minute = 28.3 h/week
Workload	
Requirements	Has taken courses in Diversity and Classification of Cryptogamae, Plant Anatomy and Morphology

Type	**CSU**	**Face to face**	**Structured activity**	**Self study**
T	2	26.7h (1.00 ECTS)	32h (1.21 ECTS)	32h (1.21 ECTS)
P	1	28.3h (1.07 ECTS)		
Total	3	119h (4.5 ECTS)		

Learning goals/competencies	PLO 2 They are able to apply the basic advance knowledge in biology to solve the problem in biology. PLO 6 They are able to select and analyze the proper technology and information or data in accomplishing tasks. PLO 8 They are able to communicate verbal and nonverbal effectively using the proper media. PLO 10 They are able to demonstrate creativity, accuracy, discipline, responsibility, adaptability, have an independent initiative, autonomous learning, and do lifelong learning CLO 1 Able to apply the concepts and principles of classification and nomenclature rules based on the 2018 International of Nomenclature for Algae, Fungi, and Plants (Shenzhen code) on selected taxons from the Pinophyita group, Basal Familia, and Magnoliid Complex through practicum. CLO2 Able to apply the principle of classification to each selected taxon from the Monocot and Eudicot groups through practicum. CLO3 Able to design project-based activities based on the surrounding natural environment CLO4 Able to communicate the results of the project based on the diversity of phanerogams.

CLO / PLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
CLO 1		*				*		*		*
CLO 2		*				*		*		*
CLO 3		*				*		*		*
CLO 4		*				*		*		*

Content:	Diversity and Classification of Phaneoragamae is a compulsory subject for the study program which includes the following studies: 1. The relationship between the concepts of evolution, reproduction and isolation with the diversity and classification of the Phanerogamae plants. 2. The principles of identification, classification and nomenclature of Phanerogamae plants based on the nomenclature rules according to the plant KITT in Vienna 2008 3. Character evolution in plants and classification based on DNA. 4. Diversity (morphological characteristics, anatomy, distribution, reproduction, phytochemical content) of the Cycadophyta and Ginkgophyta groups 5. Diversity (morphological, anatomical, distribution, reproductive, phytochemical properties) of the Coniferae / Pinophyta group (Pinopsida, Cupressopsida, and Gnetales). 6. Diversity (morphological characteristics, anatomy, distribution, reproduction, phytochemical content) of the Basal Family and Magnoliid Complex groups. 7. Diversity (morphological characteristics, anatomy, distribution, reproduction, phytochemical content) of the Commelinoid and Petaloid Alismatales Monocot Complex groups 8. Diversity (morphological characteristics, anatomy, distribution, reproduction, phytochemical content) of the Eudicot Core Eudicot Complex group 9. Diversity (morphological characteristics, anatomy, distribution, reproduction, phytochemical content) of the Eudicot Rosids group 10. Diversity (morphological characteristics, anatomy, distribution, reproduction, phytochemical content) of the Eudicot Asterids complex group

	The DCP practicum examines: 1. Specific traits, the reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of the Cycadophyta and Ginkgophyta groups. 2. Specific traits, the reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of the Coniferae / Pinophyta group (Pinopsida, Cupressopsida, and Gnetales). 3. Specific characteristics, the reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of the Basal Family and Magnoliid Complex groups. 4. Specific characteristics, the reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of the Commelinoid and Petaloid Alismatales Complex groups. 5. Specific traits, reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of the Eudicot Core Eudicot complex group. 6. Specific characteristics, reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of groups from the Eudicot Rosids complex group. 7. Specific characteristics, reasons for classification in taxon, are able to distinguish traits between families and can explain the economically useful species of the Eudicot Asterids complex group.
Attribute Soft skill	1. Able to characterize morphology of Phanerogamae 2. Able to think conceptually, analytically, and logically 3. Have good communication skills 4. Problem solving

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<table>
<tr><td>Study/exam achievements:</td><td>
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<tr><td>Aspect</td><td>(%)</td><td>CLO 1</td><td>CLO 2</td><td>CLO 3</td><td>CLO4</td></tr>
<tr><td>Participation</td><td>10</td><td>V</td><td></td><td>V</td><td></td></tr>
<tr><td>Team Based Project/Mid Term</td><td>30</td><td></td><td></td><td>V</td><td>V</td></tr>
<tr><td>Final Exam</td><td>30</td><td>V</td><td>V</td><td></td><td></td></tr>
<tr><td>Laboratory activity:
Pretes (5%)
Performance (5%)
Report (10%)
Responsi (10%</td><td>30</td><td>

V
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V</td><td>V</td></tr>
<tr><td>Final Score</td><td>100</td><td></td><td colspan="3"></td></tr>
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Students are required to attend the face-to-face lecture minimum 75% to be able to take the Mid and Final exam. Students are considered to complete the course and pass if they obtain at least 60% of maximum final score. The final score (FS) is calculated based on the following ratio:
</td></tr>
<tr><td>Form of Media</td><td>Power point slide, plant specimen, video, film</td></tr>
<tr><td>Literature (primary references)</td><td>
1. Simpson MG. 2010. Plant Systematics Second Edition. Amsterdam: Academic Press.
2. Fonseca, C. R., Paterno, G. B., Guadagnin, D. L., Venticinque, E. M., Overbeck, G. E., Ganade, G., ... & Weisser, W. W. (2021). Conservation biology: four decades of problem-and solution-based research. *Perspectives in Ecology and Conservation*.
3. Muzzazinah, Nurmiyati. (2016) .Penuntun Praktikum Keanekaragaman dan Klasifikasi Tumbuhan. Laboratorium Tumbuhan . P.Biologi . FKIP UNS.
4. Piñeiro Juncal, N. (2021). Biogeochemistry of marine phanerogams soils.
5. Calcinai, B., Bastari, A., Bavestrello, G., Bertolino, M., Horcajadas, S. B., Pansini, M., ... & Cerrano, C. (2017). Demosponge diversity from North Sulawesi, with the description of six new species. *ZooKeys*, (680), 105.
6. Sauvage, T., Ballantine, D. L., Peyton, K. A., Wade, R. M., Sherwood, A. R., Keeley, S., & Smith, C. (2020). Molecular confirmation and morphological reassessment of Udotea geppiorum (Bryopsidales, Chlorophyta) with ecological observations of mesophotic meadows in the Main Hawaiian Islands.
</td></tr>
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European Journal of Phycology, *55*(2), 186-196.

7. Reichelt, N., Wen, J., Paetzold, C., & Appelhans, M. (2021). Target enrichment improves phylogenetic resolution in the genus Zanthoxylum (Rutaceae) and indicates both incomplete lineage sorting and hybridization events. *bioRxiv*.
8. Larkum, A. W., Waycott, M., & Conran, J. G. (2018). Evolution and biogeography of seagrasses. In *Seagrasses of Australia* (pp. 3-29). Springer, Cham.
9. Meade, C. V., & Parnell, J. A. (2018). A revised taxonomy for Uvaria (Annonaceae) in continental Asia. *Australian Systematic Botany*, *31*(4), 311-356.
10. Zhang, L., & Zhang, L. B. (2018). Phylogeny and systematics of the brake fern genus Pteris (Pteridaceae) based on molecular (plastid and nuclear) and morphological evidence. *Molecular Phylogenetics and Evolution*, *118*, 265-285.

Assessment

Dimension	Weight	Score	WxS	Comments
Participation	10			
Team Based Project/Mid Term	30			
Final Exam	30			
Laboratory activity: Pretes (5%) Performance (5%) Report (10%) Responsi (10%	30			
Final Score	100%			

Rubric for Presentatiom

DIMENSION	Scale				
	Very Good	**Good**	**Sufficient**	**Deficient**	**Very Deficient**
	≥85	71-84	60-70	40-59	<40
Organization	Well organized by presenting facts that are supported by examples that have been analyzed	well organized and present convincing facts to support conclusions.	The presentation has focus and presents some evidence to support the conclusion	Sufficiently focused, but insufficient evidence to be used in drawing	There is no clear organization. Facts are not used to support statements.

	according to the concept			conclusions	
Content	Content can inspire listeners to develop their minds.	Contents are accurate and complete. Listeners get new insights about the topic.	Content is generally accurate, but incomplete. Listeners can learn some implied facts, but they don't add new insight into the topic	The content is less accurate, because there is no factual data, it does not add to the listener's understanding	The content is inaccurate or too general. Listeners don't learn anything or are sometimes mislead.
Presentation Style	Speak with passion, transmit enthusiasm and enthusiasm to listeners	The speaker is calm and uses proper intonation, speaks without relying on notes, and interacts intensively with the listener. The speaker always makes eye contact with the listener.	In general the speaker is calm, but with a flat tone and quite often relies on notes. Sometimes eye contact with the listener is ignored.	Based on the notes, no ideas are developed outside the notes, the sound is monotonous	The speaker is anxious and uncomfortable, and reads notes rather than speaking. Listeners are often ignored. There is no eye contact because the speaker is looking more at the whiteboard or screen.

FINAL EXAM

Rubric

CLO	Question	Answer
CLO 1	1. The APG IV system of flowering plant classification is the fourth version of a modern, mostly molecular-based, system of plant taxonomy for flowering plants (angiosperms) being developed by the Angiosperm Phylogeny Group	1) The classification system based on phylogeny, chronologically = gis can be explained as follows: a. Since the publication of The Origin of Species and the acceptance of Darwin's theory of evolution, there has been dissatisfaction with de Candolle's system. The systems that emerged in this period included elements of the evolutionary process, which was then accepted by biologists that the life that exists today is the result of the evolutionary process. b. In the classification system, the existing species are no longer static, steady, and unchanging, but are populations that are varied, dynamic, always changing, and are recognized as descendants of previously

	(APG). It was published in 2016, seven years after its predecessor the APG III system was published in 2009, and 18 years after the first APG system was published in 1998. Explain the classification system of Angiosperms based on a phylogenetic approach.	existing species. A taxon has members that are closely related to each other because they come from a common ancestor through the process of evolution. In the phylogenetic system, the order of classification also shows the phylogenetic order. The basis used is mainly kinship and primitive nature and the advancement of a group. This system developed rapidly especially with the widespread acceptance of Darwin's theory. From his theory, botanists argue that the forms of life that exist today are the result of an evolutionary process. Attempts to find this kind of phylogenetic relationship are carried out by grouping living organisms into a series starting from the most primitive forms to the most advanced forms. c. The classification of plants in the phylogenetic system assumes that the first direction in the evolution of the plant and animal world starts from organisms that are considered primitive (simple) to more complex (advanced) forms. The diversity generated by the motion of evolutionary mechanisms allows us to group organisms into types, genera, tribes, nations, classes and divisions, and arrange them into an orderly sequence. All of these things are based on the presence of primitive or advanced traits in plants. In general, a group of plants is considered to have the closest (closest) relationship, if there are similar characteristics or signs. While the kinship relationship is considered the most tenuous (far) if very few of the same characteristics are found.
	2. Indonesia, a country that has prodigious biodiversity, is a combination of biodiversity as well as Asia and Australia (Australasia) and the meeting zone of the two continents. Land area of Indonesia totalled 1,919,440 km and an area of the waters of the 3,257,483 km with a coastline along the 99,093 km (BIG 2013). Why is it still considered important and urgent for research in the field	2) Biodiversity is important to most aspects of our lives. We value biodiversity for many reasons, some utilitarian, some intrinsic. This means we value biodiversity both for what it provides to humans, and for the value it has in its own right. Utilitarian values include the many basic needs humans obtain from biodiversity such as food, fuel, shelter, and medicine. Further, ecosystems provide crucial services such as pollination, seed dispersal, climate regulation, water purification, nutrient cycling, and control of agricultural pests. Biodiversity also holds value for potential benefits not yet recognized, such as new medicines and other possible unknown services. Biodiversity has cultural value to humans as well, for spiritual or religious reasons for instance. The intrinsic value of biodiversity refers to its inherent worth, which is independent of its value to anyone or anything else. This is more of a philosophical concept, which can be thought of as the inalienable right to exist. Finally, the value of biodiversity can also be understood through the lens of the relationships we form and strive for with each other and the

	of biodiversity, especially plants?	rest of nature. We may value biodiversity because of how it shapes who we are, our relationships to each other, and social norms. These relational values are part of peoples' individual or collective sense of wellbeing, responsibility for, and connection with the environment. The different values placed on biodiversity are important because they can influence the conservation decisions people make every day.
	3. During 1 semester you have completed a plant diversity project.Explain and how do you do the project from MK KKP. Please state in full the type you describe.	3) Students describe individual projects that have been done
	4. Why do species names have to be scientific names and become world conventions? Give an explanation and reason.	4) These names are important because they allow people throughout the world to communicate unambiguously about animal species. This works because there are sets of international rules about how to name animals and zoologists try to avoid naming the same thing more than once, though this does sometimes happen. These naming rules mean that every scientific name is unique. For example, if bluegill sunfish are given the scientific name *Lepomis macrochirus*, no other animal species can be given the same name. So, if you are a Russian scientist studying relatives of sunfish and you want to discuss bluegill sunfish with a Canadian researcher, you both use the scientific name and know exactly what the other is talking about.
	5. State the specific characteristics of Piperaceae.?	5) He leaves of Piperaceae, which have a pungent flavour, grow singly. The numerous flowers, lacking sepals and petals, are crowded in dense spikes. *Piper* species are mostly shrubs, woody vines, and small trees. Many are used in medicines and in food and beverages as spices and seasonings. *Piper nigrum* is a 9-metre (30-foot) woody climber native to southern India and to Sri Lanka; it is cultivated in most tropical regions where soil moisture is

		constant and temperatures are reliably warm. The pungency of *Piper* peppers is attributed to chavicine, a resin. Also present are the alkaloids piperine (which lends pungency to brandy) and piperidine. An essential oil distilled from peppercorns is used to make meat sauces.
	6. Describe the characteristics of Araceae that distinguish it from other families in Alismatales	6) The characteristics of the family, high species diversity and high rates of endemism, are likely interrelated in the matter of speciation in the family. It is uncertain what causes the high rates of endemism in Araceae but coevolution with the large bee genus, *Euglossa*, among others, and the limited dispersal ranges of berries by non-migratory, often territorial forest birds, has probably created small isolated populations which could have speciated on their own. Endemism is prevalent in many parts of the Neotropics and it is not just restricted to the wet tropics.
	7. Describe the characteristics of Orchidaceae that distinguish it from other families in Asparagales	7) The Orchidaceae are terrestrial, epiphytic, or saprophytic herbs comprising one of the two largest families of flowering plants with about 1,000 genera and 15-20,000 species. The leaves are alternate or seldom opposite or whorled and have a sheathing base and an entire, often fleshy, parallel-veined blade. The flowers are typically zygomorphic and bisexual but sometimes are virtually actinomorphic and rarely are unisexual. The perianth consists of 6 tepals in two similar or dissimilar whorls. The outer whorl of 3 distinct or variously connate tepals is sometimes sepaloid. Two members of the inner whorl of 3 tepals are alike and may be quite similar to the outer tepals. The third tepal of the inner whorl forms a labellum that typically is highly modified in shape and or coloration. The androecium and gynoecium are nearly always adnate into a column or gynostegium. Orchids in subfamily Cypripedioideae have two stamens, one on each side of the column. Orchids in the largest subfamily Orchidoideae have a single terminal stamen and the anthers generally produce one or more waxy masses of pollen called pollinia. The gynoecium consists of a single compound pistil of 3 carpels that together with the androecium comprises the column in most species. The stigma is just proximal to the single terminal stamen in most species. The stigma is two- or three-lobed and the ovary is inferior and almost always has 1 locule with very numerous, up to several million, very tiny parietal ovules. The fruit is mostly capsular.