| | Universitas Negeri Surabaya<br>Faculty of Mathematics and Natural Sciences Natural Sciences Education Undergraduate Study Program | Document Code |
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# SEMESTER LEARNING PLAN

| Courses | CODE | Course Family | Credit Weight | | | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|---|
| Earth and Space Knowledge | 8420103123 | Compulsory Study Program Subjects | T=3 | P=0 | ECTS=4.77 | 4 | February 2, 2024 |

| AUTHORIZATION | SP Developer | Course Cluster Coordinator | Study Program Coordinator |
|---|---|---|---|
| | Ahmad Fauzi Hendratmoko, M.Pd.; Tutut Nurita, S.Pd., M.Pd.; An Nuril Maulida Fauziah, S.Pd., M.Pd.; Muhamad Arif Mahdianur, S.Pd., M.Pd.; Dyah Puspitasari, M.Pd. | Prof. Dr. Wahono Widodo, M.Si. | Prof. Dr. Erman, M.Pd. |

**Learning model:** Case Studies

**Program Learning Outcomes (PLO)**

**PLO study program that is charged to the course**

**Program Objectives (PO)**

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| **PO - 1** | Able to show a responsible attitude, demonstrate a scientific, critical and innovative attitude independently during the lecture process. |
| **PO - 2** | Able to master physical phenomena on earth and space, including: the structure of the earth, lithosphere, atmosphere, solar system and other celestial bodies, as well as analyzing the theory of the evolution of the universe. |
| **PO - 3** | Able to show a responsible attitude, demonstrate a scientific, critical and innovative attitude independently during the lecture process. |

**PLO-PO Matrix**

| P.O |
|---|
| PO-1 |
| PO-2 |
| PO-3 |

**PO Matrix at the end of each learning stage (Sub-PO)**

| P.O | Week | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| PO-1 | | | | | | | | | | | | | | | | |
| PO-2 | | | | | | | | | | | | | | | | |
| PO-3 | | | | | | | | | | | | | | | | |

**Short Course Description:** This course discusses physical phenomena on earth and space, including: the structure of the earth, lithosphere, atmosphere, solar system and other celestial bodies, as well as analyzing the theory of evolution of the universe.

**References**

**Main :**


1. Trefil, J. and Hazen, R.M. (2016). The Sciences: An Integrated Approach. Wiley Global Education
2. Lunine, J.I.(2013). Earth: evolution of a habitable world. Cambridge University Press.
3. Hewitt, P.G., Lyons, S.A., Suchocki, J.A. and Yeh, J.(2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.
4. Roy, A.E. and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press
5. Ringwood, A.E. (2012). Origin of the Earth and Moon. Springer Science & Business Media.
6. Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J.(2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox
7. Selin, H. ed.(2012). Astronomy across cultures: the history of non-Western astronomy (Vol. 1). Springer Science & Business Media.
8. Tim Pengembang Bahan Ajar IPBA. n.d. Buku Ajar IPBA. Unesa University Press.


**Supporters:**

1. “Sky Map - Apps on Google Play”. n.d. , available at: https://play.google.com/store/apps/details?id=com.google.android.stardroid&hl=en (accessed 9 December 2019).
2. “SkyView® Lite - Apps on Google Play”. n.d. , available at: https://play.google.com/store/apps/details?id=com.t11.skyviewfree&hl=en (accessed 9 December 2019).
3. “Apparent retrograde motion - Wikipedia”. n.d., available at: https://en.wikipedia.org/wiki/Apparent_retrograde_motion (accessed 9 December 2019).
4. “Kalender Jawa - Wikipedia bahasa Indonesia, ensiklopedia bebas”. n.d., available at: https://id.wikipedia.org/wiki/Kalender_Jawa (accessed 9 December 2019).
5. “Kalender Jawa Sultan Agungan | Karaton Ngayogyakarta Hadiningrat - Kraton Jogja”. n.d., available at: https://www.kratonjogja.id/ragam/21/kalender-jawa-sultan-agungan (accessed 9 December 2019).
6. “Perseid meteors 2019: All you need to know | Astronomy Essentials | EarthSky”. n.d., available at: https://earthsky.org/astronomy-essentials/everything-you-need-to-know-perseid-meteor-shower (accessed 9 December 2019).
7. Divisi Pertanian. n.d. Panduan Praktis Menentukan Saat Tanam Berdasarkan Pranoto Mongso, available at: www.pplhseloliman.or.id (accessed 9 December 2019).
8. “Pranata mangsa - Wikipedia bahasa Indonesia, ensiklopedia bebas”. n.d., available at: https://id.wikipedia.org/wiki/Pranata_mangsa (accessed 9 December 2019).


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| **Supporting lecturer** | Prof.Dr. Wahono Widodo, M.Si.<br>Dr. Elok Sudibyo, S.Pd.,M.Pd.<br>Tutut Nurita, S.Pd., M.Pd.<br>An Nuril Maulida Fauziah, S.Pd., M.Pd.<br>Muhamad Arif Mahdiannur, S.Pd., M.Pd.<br>Dyah Permata Sari, S.Pd., M.Pd.<br>Ahmad Fauzi Hendratmoko, M.Pd. |

| Week- | Final abilities of each learning stage (Sub-PO) | Evaluation | | Help Learning, Learning methods, Student Assignments, [ Estimated time] | | Learning materials [ References ] | Assessment Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Form | Offline ( *offline* ) | Online ( *online* ) | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1 | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of the earth (lithosphere)<br>2. Analyzing information on the layers of the earth (lithosphere)<br>3. Analyzing natural phenomena in the lithosphere layer, including the mechanism of volcanic eruptions, earthquakes and tsunamis<br>4. Communicate efforts to overcome natural disasters in the lithosphere layer | **Criteria:**<br>Accuracy in understanding and analyzing the characteristics of the lithosphere and disasters that occur in the lithosphere<br><br>**Form of Assessment** :<br>Participatory Activities | Case studies<br>3 x 50‘ | Case study via LMS Unesa<br>3 x 60‘ | **Material:** Earth‘s Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Earth‘s Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Lunine, JI (2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Earth‘s Lithosphere Layer and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Earth‘s Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |

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| **2** | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of the earth (lithosphere)<br>2. Analyzing information on the layers of the earth (lithosphere)<br>3. Analyzing natural phenomena in the lithosphere layer, including the mechanism of volcanic eruptions, earthquakes and tsunamis<br>4. Communicate efforts to overcome natural disasters in the lithosphere layer | **Criteria:**<br>Accuracy in understanding and analyzing the characteristics of the lithosphere and disasters that occur in the lithosphere<br><br>**Form of Assessment** : Participatory Activities | Case studies<br>3 x 50'<br>3 x 60' | Case study via LMS Unesa | **Material:** Earth's Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Earth's Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Lunine, JI (2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Earth's Lithosphere Layer and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Earth's Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |
| **3** | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of the earth (lithosphere)<br>2. Analyzing information on the layers of the earth (lithosphere)<br>3. Analyzing natural phenomena in the lithosphere layer, including the mechanism of volcanic eruptions, earthquakes and tsunamis<br>4. Communicate efforts to overcome natural disasters in the lithosphere layer | **Criteria:**<br>Accuracy in understanding and analyzing the characteristics of the lithosphere and disasters that occur in the lithosphere<br><br>**Form of Assessment** : Participatory Activities, Tests | Case studies<br>3 x 50'<br>3 x 60' | Case study via LMS Unesa | **Material:** Earth's Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Earth's Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Lunine, JI (2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Earth's Lithosphere Layer and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Earth's Lithosphere Layers and Various Disasters in the Lithosphere and Their Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |

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| **4** | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of Earth (hydrosphere)<br>2. Analyze information on the hydrological cycle on Earth<br>3. Analyzing natural phenomena affected by the hydrosphere layer<br>4. Analyze the effects of human activities that can cause pollution in the hydrosphere layer<br>5. Communicate mitigation efforts for the hydrosphere affected by natural disasters and human-caused pollution | **Criteria:**<br>Accuracy in explaining and analyzing the characteristics of the Earth's hydrosphere, the hydrological cycle, as well as disasters in the hydrosphere and their mitigation<br><br>**Form of Assessment** : Participatory Activities | Case studies<br>3 x 50'<br>3 x 60' | Case study via LMS Unesa | **Material:** Hydrosphere, Hydrological Cycle, and Potential for Disasters in the Earth's Hydrosphere and Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Hydrosphere, Hydrological Cycle, and Potential Disasters in the Earth's Hydrosphere and Mitigation References **:** *Lunine, JI(2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Hydrosphere, Hydrological Cycle, and Potential for Disasters in the Earth's Hydrosphere and Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Hydrosphere, Hydrological Cycle, and Potential for Disasters in the Earth's Hydrosphere and Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |
| **5** | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of Earth (hydrosphere)<br>2. Analyze information on the hydrological cycle on Earth<br>3. Analyzing natural phenomena affected by the hydrosphere layer<br>4. Analyze the effects of human activities that can cause pollution in the hydrosphere layer<br>5. Communicate mitigation efforts for the hydrosphere affected by natural disasters and human-caused pollution | **Criteria:**<br>Accuracy in explaining and analyzing the characteristics of the Earth's hydrosphere, the hydrological cycle, as well as disasters in the hydrosphere and their mitigation<br><br>**Form of Assessment** : Participatory Activities, Tests | Case studies<br>3 x 50'<br>3 x 60' | Case study via LMS Unesa | **Material:** Hydrosphere, Hydrological Cycle, and Potential for Disasters in the Earth's Hydrosphere and Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Hydrosphere, Hydrological Cycle, and Potential Disasters in the Earth's Hydrosphere and Mitigation References **:** *Lunine, JI(2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Hydrosphere, Hydrological Cycle, and Potential for Disasters in the Earth's Hydrosphere and Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Hydrosphere, Hydrological Cycle, and Potential for Disasters in the Earth's Hydrosphere and Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |

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| **6** | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of the Earth (atmosphere)<br>2. Analyze information on Earth's atmospheric layers<br>3. Analyze activities in nature that affect the layers of the atmosphere<br>4. Analyzing the effects of human activities that can cause pollution in the atmosphere<br>5. Communicate mitigation efforts for the atmosphere affected by natural disasters and human-caused pollution<br>6. Utilizing science and technology to solve problems related to atmospheric layers | **Criteria:**<br>Accuracy in explaining and analyzing the characteristics of the Earth's atmosphere, factors that influence the atmosphere, pollution, potential disasters in the atmosphere and their mitigation<br><br>**Form of Assessment** :<br>Participatory Activities | Case studies<br>3 x 50' | Case study via LMS Unesa<br>3 x 60' | **Material:** Atmosphere, Pollution, and Potential for Disasters in the Atmosphere and Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Atmosphere, Pollution, and Potential Disasters in the Atmosphere and Mitigation<br>**References:** *Lunine, JI (2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Atmosphere, Pollution, and Potential for Disasters in the Atmosphere and Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Atmosphere, Pollution, and Potential Disasters in the Atmosphere and Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |
| **7** | Analyze physical phenomena on earth by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the characteristics of the Earth (atmosphere)<br>2. Analyze information on Earth's atmospheric layers<br>3. Analyze activities in nature that affect the layers of the atmosphere<br>4. Analyzing the effects of human activities that can cause pollution in the atmosphere<br>5. Communicate mitigation efforts for the atmosphere affected by natural disasters and human-caused pollution<br>6. Utilizing science and technology to solve problems related to atmospheric layers | **Criteria:**<br>Accuracy in explaining and analyzing the characteristics of the Earth's atmosphere, factors that influence the atmosphere, pollution, potential disasters in the atmosphere and their mitigation<br><br>**Form of Assessment** :<br>Participatory Activities, Tests | Case studies<br>3 x 50' | Case study via LMS Unesa<br>3 x 60' | **Material:** Atmosphere, Pollution, and Potential for Disasters in the Atmosphere and Mitigation<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Atmosphere, Pollution, and Potential Disasters in the Atmosphere and Mitigation<br>**References:** *Lunine, JI (2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** Atmosphere, Pollution, and Potential for Disasters in the Atmosphere and Mitigation<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Atmosphere, Pollution, and Potential Disasters in the Atmosphere and Mitigation<br>**References:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |

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| **8** | Midterm Exam (UTS) | Sub-CPMK 1 to Sub-CPMK 7 | **Criteria:**<br>Accuracy and mastery according to the UTS assessment indicators (assessment rubric).<br><br>**Form of Assessment** :<br>Test | UTS<br>100' | UTS<br>100' | | 10% |
| **9** | Analyze the solar system (earth, moon, sun, planets of the solar system) and the influence of the Earth's rotation and revolution on life by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the theory of the origin of the solar system<br>2. Analyze the solar system<br>3. Identify planets and their satellites in the solar system<br>4. Analyze the process of lunar eclipses and solar eclipses<br>5. Utilize science and technology to solve problems related to the solar system | **Criteria:**<br>Accuracy and understanding of the theory of the origin of the solar system and members of the solar system<br><br>**Form of Assessment** :<br>Participatory Activities | Case studies<br>3 x 50' | Case study via LMS<br>Unesa<br>3 x 60' | **Material:** Theory of the Origin of the Solar System and Members of the Solar System<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Theory of the Origin of the Solar System and Members of the Solar System<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Theory of the Origin of the Solar System and Members of the Solar System<br>**References:** *Roy, AE and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press*<br><br>**Material:** Theory of the Origin of the Solar System and Members of the Solar System<br>**References:** *Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J. (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox*<br><br>**Material:** Theory of the Origin of the Solar System and Members of the Solar System<br>**Literature:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |
| **10** | Analyze the solar system (earth, moon, sun, planets of the solar system) and the influence of the Earth's rotation and revolution on life by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the theory of the origin of the solar system<br>2. Analyze the solar system<br>3. Identify planets and their satellites in the solar system<br>4. Analyze the process of lunar eclipses and solar eclipses<br>5. Utilize science and technology to solve problems related to the solar system | **Criteria:**<br>Accuracy and understanding of the criteria for planets, satellites, asteroids, meteors, meteoroids, and solar and lunar eclipses<br><br>**Form of Assessment** :<br>Participatory Activities | Case studies<br>3 x 50' | Case study via LMS<br>Unesa<br>3 x 60' | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Roy, AE and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and | 5% |

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| | | | | | | | Solar and Lunar Eclipses<br>**References:** *Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J. (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Selin, H. ed. (2012). Astronomy across cultures: the history of non-Western astronomy (Vol. 1). Springer Science & Business Media.* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Library:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Library:** *"Sky Map - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Library:** *"SkyView® Lite - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Eclipses of the Sun and Moon<br>**Reference:** *"Apparent retrograde motion - Wikipedia". nd, available at: https://en.wikipedia.org/... (accessed 9 December 2019).* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *"Javanese Calendar - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *"Sultan Agungan Javanese Calendar \| Ngayogyakarta Hadiningrat Palace - Jogja Palace". nd, available at: https://www.kratonjogja.id/... (accessed 9 December 2019).* | |
| | | | | | | | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *"Perseid meteors 2019: All you need to know \| Astronomy Essentials \| EarthSky." nd, available at: https://earthsky.org/...* | |

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| | | | | | | *(accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *Agriculture Division. nd Practical Guide to Determining When to Plant Based on Pranoto Mongso, available at: www.pplhseloliman.or.id (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Bibliography:** *"Prey planets - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).* | |
| **11** | Analyze the solar system (earth, moon, sun, planets of the solar system) and the influence of the Earth's rotation and revolution on life by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the theory of the origin of the solar system<br>2. Analyze the solar system<br>3. Identify planets and their satellites in the solar system<br>4. Analyze the process of lunar eclipses and solar eclipses<br>5. Utilize science and technology to solve problems related to the solar system | **Criteria:**<br>Accuracy and understanding of the criteria for planets, satellites, asteroids, meteors, meteoroids, and solar and lunar eclipses<br><br>**Form of Assessment** : Participatory Activities, Tests | Case studies<br>3 x 50' | Case study via LMS Unesa<br>3 x 60' | **Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Roy, AE and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J. (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**References:** *Selin, H. ed. (2012). Astronomy across cultures: the history of non-Western astronomy (Vol. 1). Springer Science & Business Media.*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Library:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Library:** *"Sky Map - Apps on Google Play". nd, available at: https://play.google.com/...* | 5% |

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| | | | | | | *(accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Library:** *"SkyView® Lite - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Eclipses of the Sun and Moon<br>**Reference:** *"Apparent retrograde motion - Wikipedia". nd, available at: https://en.wikipedia.org/... (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *"Javanese Calendar - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *"Sultan Agungan Javanese Calendar \| Ngayogyakarta Hadiningrat Palace - Jogja Palace". nd, available at: https://www.kratonjogja.id/... (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *"Perseid meteors 2019: All you need to know \| Astronomy Essentials \| EarthSky." nd, available at: https://earthsky.org/... (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Literature:** *Agriculture Division. nd Practical Guide to Determining When to Plant Based on Pranoto Mongso, available at: www.pplhseloliman.or.id (accessed 9 December 2019).*<br><br>**Material:** Planets, Satellites, Asteroids, Meteors, Meteoroids, and Solar and Lunar Eclipses<br>**Bibliography:** *"Prey planets - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).* | |
| **12** | Analyze the evolution of stars by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the theory of stars<br>2. Analyze the sun as a star<br>3. Analyze the characteristics of stars in the Hertzprung | **Criteria:**<br>Accuracy and understanding of the theory of stellar evolution<br><br>**Form of Assessment** :<br>Participatory Activities | Case studies<br>3 x 50' | Case study via LMS Unesa<br>3 x 60' | **Material:** Stars (the sun as a star, the Hertzprung Russell diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated* | 5% |

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| | | Russell diagram<br>4. Explains the evolution of stars<br>5. Analyze possible futures of stars based on their size and luminosity | | | | *Approach. Wiley Global Education*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russell diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J. (2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russell diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *Roy, AE and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russell diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J . (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *Selin, H. ed. (2012). Astronomy across cultures: the history of non-Western astronomy (Vol. 1). Springer Science & Business Media.*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Library:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Library:** *"Sky Map - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Library:** *"SkyView® Lite - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity) | | |

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| | | | | | | **References:** *"Apparent retrograde motion - Wikipedia". nd, available at: https://en.wikipedia.org/... (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *"Javanese Calendar - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *"Sultan Agungan Javanese Calendar \| Ngayogyakarta Hadiningrat Palace - Jogja Palace". nd, available at: https://www.kratonjogja.id/... (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *"Perseid meteors 2019: All you need to know \| Astronomy Essentials \| EarthSky". nd, available at: https://earthsky.org/... (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, stellar evolution, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *Agricultural Division. nd Practical Guide to Determining When to Plant Based on Pranoto Mongso, available at: www.pplhseloliman.or.id (accessed 9 December 2019).*<br><br>**Material:** Stars (the sun as a star, the Hertzprung Russel diagram, the evolution of stars, and the possible future of stars based on their size and luminosity)<br>**Bibliography:** *"Prey systems - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).* | |
| **13** | Analyze the evolution of stars by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explain the theory of stellar cosmology<br>2. Describe galaxies and clusters<br>3. Analyzing star motion based on redshift<br>4. Evaluate the evidence supporting the big bang theory<br>5. Describe dark matter and dark energy | **Criteria:**<br>Accuracy and understanding of the theory of stellar evolution<br><br>**Form of Assessment** : Participatory Activities, Tests | Case studies<br>3 x 50'<br>3 x 60' | Case study via LMS Unesa | **Material:** Astrological Cosmology<br>**Bibliography:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Astrological Cosmology<br>**Bibliography:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J.(2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** Astrological | 5% |

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| | | 6. Describe the grand structure of the universe<br>7. Linking the results of James Webb telescope data analysis with the big bang theory. | | | | Cosmology<br>**Bibliography:** *Roy, AE and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press*<br><br>**Material:** Astrological Cosmology<br>**Bibliography:** *Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J. (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox*<br><br>**Material:** Astrological Cosmology<br>**Bibliography:** *Selin, H. ed. (2012). Astronomy across cultures: the history of non-Western astronomy (Vol. 1). Springer Science & Business Media.*<br><br>**Material:** Astrological Cosmology<br>**Library:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.*<br><br>**Material:** Astrological Cosmology<br>**Library:** *"Sky Map - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Library:** *"SkyView® Lite - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Bibliography:** *"Apparent retrograde motion - Wikipedia". nd, available at: https://en.wikipedia.org/... (accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Library:** *"Javanese Calendar - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Literature:** *"Sultan Agungan's Javanese Calendar \| Ngayogyakarta Hadiningrat Palace - Jogja Palace". nd, available at: https://www.kratonjogja.id/... (accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Library:** *"Perseid meteors 2019: All you need to know \| Astronomy Essentials \| EarthSky". nd, available at: https://earthsky.org/... (accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Library:** *Agriculture Division. nd Practical Guide to Determining When to Plant Based on Pranoto Mongso, available at: www.pplhseloliman.or.id* | |

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| | | | | | | *(accessed 9 December 2019).*<br><br>**Material:** Astrological Cosmology<br>**Bibliography:** *"Puration order - Indonesian Wikipedia, the free encyclopedia". nd, available at: https://id.wikipedia.org/... (accessed 9 December 2019).* | |
| **14** | Analyze the Earth (origin, origin of the hydrosphere, origin of life) by utilizing science and technology to explore data and information and be responsible for self-learning, assignments and agreements with the team in completing assignments. | 1. Explains the theory of the origins of the Earth, the hydrosphere layer, and the beginning of life on Earth<br>2. Analyze the theory of the origins of the Earth, the hydrosphere layer, and the beginning of life on Earth<br>3. Identify theories of the origins of the Earth, hydrosphere layers, and the beginning of life on Earth<br>4. Analyze the process of the Earth, the hydrosphere and the beginning of life on Earth<br>5. Utilizing science and technology to solve problems related to the earth | **Criteria:**<br>Accuracy and understanding of the Earth (origin, origin of the hydrosphere, origin of life)<br><br>**Form of Assessment** :<br>Participatory Activities | Case studies<br>3 x 50'<br><br>Case study via LMS Unesa<br>3 x 60' | | **Material:** Earth (Origin, Origin of the Hydrosphere, Origin of Life)<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** Earth (Origin, Origin of the Hydrosphere, Origin of Life)<br>**References:** *Ringwood, AE (2012). Origin of the Earth and Moon. Springer Science & Business Media.*<br><br>**Matter:** Earth (Origin, Origin of the Hydrosphere, Origin of Life)<br>**References:** *Druyan, A., MacFarlane, S., Cannold, M., Braga, B. and Clark, J. (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox*<br><br>**Material:** Earth (Origin, Origin of the Hydrosphere, Origin of Life)<br>**Library:** *IPBA Teaching Materials Development Team. nd IPBA Textbook. Unesa University Press.* | 5% |
| **15** | Make proposals, activity plans, and project products (portfolio) related to PBA learning media by utilizing science and technology and be responsible for self-learning, assignments, and agreement/cooperation with the team in completing assignments. | 1. Create and perfect teaching aids and guidebooks related to the material topics that have been given<br>2. Carry out the steps of the scientific method in completing the teaching aids<br>3. Utilize science and technology to solve problems related to teaching aids according to the topic material that has been given<br>4. Present the results of the teaching aids along with the guidelines according to the material that has been provided | **Criteria:**<br>Creativity and accuracy according to the substantive concepts of PBA and Rubrics<br><br>**Form of Assessment** :<br>Project Results Assessment / Product Assessment | Case studies<br>3 x 50'<br><br>Case study via LMS Unesa<br>3 x 60' | | **Materials:** PBA Media Project<br>**References:** *Trefil, J. and Hazen, RM (2016). The Sciences: An Integrated Approach. Wiley Global Education*<br><br>**Material:** PBA Media Project<br>**Reference:** *Lunine, JI(2013). Earth: evolution of a habitable world. Cambridge University Press.*<br><br>**Material:** PBA Media Project<br>**References:** *Hewitt, PG, Lyons, SA, Suchocki, JA and Yeh, J.(2013). Conceptual Integrated Science: Pearson New International Edition. Pearson Higher Ed.*<br><br>**Material:** PBA Media Project<br>**Bibliography:** *Roy, AE and Clarke, D. (2003). Astronomy: Principles and Practice, (PBK). CRC Press*<br><br>**Material:** PBA Media Project<br>**Reference:** *Ringwood, AE (2012). Origin of the Earth and Moon. Springer Science & Business Media.*<br><br>**Material:** PBA Media Project<br>**Bibliography:** *Druyan, A.,* | 15% |

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| | | | | | | | *MacFarlane, S., Cannold, M., Braga, B. and Clark, J. (2014). The cosmos: A spacetime odyssey [Video Series]. Beverly Hills, CA: Twentieth Century Fox* | |
| | | | | | | | **Material:** PBA Media Project<br>**Reference:** *Selin, H. ed. (2012). Astronomy across cultures: the history of non-Western astronomy (Vol. 1). Springer Science & Business Media.* | |
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| | | | | | | | **Material:** PBA Media Project<br>**Library:** *"Sky Map - Apps on Google Play". nd, available at: https://play.google.com/... (accessed 9 December 2019).* | |
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| | | | | | | | **Material:** PBA Media Project<br>**Bibliography:** *"Prey structures - Indonesian Wikipedia, the free* | |

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| **16** | Final Semester Examination (UAS) | Sub-CPMK 1 to Sub-CPMK 15 | **Criteria:** Accuracy and mastery according to the UAS assessment indicators (assessment rubric).<br><br>**Form of Assessment** : Test | UAS 100' | UAS 100' | | 10% |

**Evaluation Percentage Recap: Case Study**

| No | Evaluation | Percentage |
|---|---|---|
| 1. | Participatory Activities | 52.5% |
| 2. | Project Results Assessment / Product Assessment | 15% |
| 3. | Test | 32.5% |
| | | 100% |

**Notes**

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.