	Universitas Negeri Surabaya **Fakultas Matematika dan Ilmu Pengetahuan Alam** **Program Studi S1 Fisika**	**Kode Dokumen**

RENCANA PEMBELAJARAN SEMESTER

MATA KULIAH (MK)	KODE	Rumpun MK	BOBOT (sks)			SEMESTER	Tgl Penyusunan
Fisika Tsunami	4520102246	Mata Kuliah Pilihan Program Studi	T=2	P=0	ECTS=3.18	6	29 Juli 2021

OTORISASI	Pengembang RPS	Koordinator RMK	Koordinator Program Studi
	Prof. Tjipto Prastowo, Ph.D.	Prof. Tjipto Prastowo, Ph.D.	Prof. Dr. Munasir, S.Si., M.Si.

Model Pembelajaran	**Project Based Learning**	
Capaian Pembelajaran (CP)	**CPL-PRODI yang dibebankan pada MK**	
	CPL-1	Mampu menunjukkan nilai-nilai agama, kebangsaan dan budaya nasional, serta etika akademik dalam melaksanakan tugasnya
	CPL-3	Mengembangkan pemikiran logis, kritis, sistematis, dan kreatif dalam melakukan pekerjaan yang spesifik di bidang keahliannya serta sesuai dengan standar kompetensi kerja bidang yang bersangkutan
	CPL-6	Mampu merumuskan gejala dan masalah fisis berdasarkan hasil observasi dan eksperimen, serta memodelkannya menggunakan matematika dan komputasi untuk pengambilan keputusan yang tepat baik dalam masalah familier maupun baru
	CPL-7	Menguasai pengetahuan tentang teknologi yang berdasarkan Fisika dan penerapannya.
	CPL-9	Mampu mengambil keputusan strategis berdasarkan analisis data dan informasi dalam rangka memenuhi serta mengevaluasi tanggung jawab dan tugasnya.
	Capaian Pembelajaran Mata Kuliah (CPMK)	
	CPMK - 1	Demonstrating independent, creative and honest characters in doing student assignments, mid and final exams.
	CPMK - 2	Understanding the concepts and zones of generation, propagation, and mitigation of a tsunami wave.
	CPMK - 3	Understanding possible tsunami sources of seismotectonic and non-seismotectonic origin.
	CPMK - 4	Understanding the concepts of non-dispersive tsunamis and the corresponding wave speed in the open ocean.
	CPMK - 5	Understanding the concepts of dispersive tsunamis and the corresponding wave speed in the open ocean.
	CPMK - 6	Understanding the effects of ocean floor deformation, ocean water compressibility on the long wave speed.
	CPMK - 7	Understanding the concepts of tsunami onset time, travel time, arrival time, and time delay.
	CPMK - 8	Understanding the concepts of tsunami wave height, tsunami run-up, and horizontal inundation.
	Matrik CPL - CPMK	

CPMK	CPL-1	CPL-3	CPL-6	CPL-7	CPL-9
CPMK-1	✔	✔			
CPMK-2		✔	✔		
CPMK-3			✔	✔	
CPMK-4			✔	✔	
CPMK-5		✔	✔	✔	
CPMK-6			✔	✔	
CPMK-7			✔	✔	
CPMK-8			✔	✔	✔

Matrik CPMK pada Kemampuan akhir tiap tahapan belajar (Sub-CPMK)

CPMK	Minggu Ke															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CPMK-1																✔
CPMK-2	✔													✔	✔	
CPMK-3		✔	✔													
CPMK-4				✔	✔											
CPMK-5						✔	✔									
CPMK-6									✔	✔						
CPMK-7											✔					
CPMK-8												✔	✔			

Deskripsi Singkat MK	The Physics of Tsunamis examines tsunamis as a series of surface long waves in the ocean generated by an impulsive geophysical disturbance that abruptly, vertically displaces the ocean water column. This course discusses earthquakes, submarine landslides, and volcanic eruptions that are considered as the most possible sources of tsunami excitation in the ocean. During its propagation from the source to coastal regions far away, the wave speed may or may not be influenced by ocean topography or ocean water characteristics. In this context, class discussions include shallow-water and deep-water approximation, non-dispersive and dispersive tsunamis, and time and spatial analysis of a tsunami wave arrival at shorelines. Tsunami hazard analysis is also discussed, emphasizing on important aspects of tsunami mitigation.
Pustaka	**Utama :**
	1. Ward, S. N. 2011. Encyclopedia of Solid Earth Geophysics: Tsunami. Edited by Harsh K. Gupta. National Geophysical Research Institute (NGRI). Council 52 of Scientific and Industrial Research (CSIR). Dordrecht, Netherlands: Springer, pp. 1-1539. e-ISBN: 978-90-481-8702-7. 2. Kundu, P. K. and Cohen, I. M. 2002. Fluid Mechanics. 2nd Edition. San Diego, US: Academic Press, pp. 1-730. ISBN-13: 978-0121782511. 3. Pain, H. J. 2005. The Physics of Vibrations and Waves. 6th Edition. West Sussex, UK: John Wiley & Sons, pp. 1-557. ISBN: 978-0-470-01295-6. 4. Sorensen, R. M. 2006. Basic Coastal Engineering. 3rd Edition. New Delhi, India: Springer US, pp. 1-324. e-ISBN: 978-0-387-23333-8. 5. Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.
	Pendukung :
	1. Some power point files and/or course materials relevant to tsunami hazard study from the internet.
Dosen Pengampu	Prof. Tjipto Prastowo, Ph.D. Arie Realita, M.Si. Muhammad Nurul Fahmi, S.Si., M.Si.

Mg Ke-	**Kemampuan akhir tiap tahapan belajar (Sub-CPMK)**	**Penilaian**		**Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]**		**Materi Pembelajaran [Pustaka]**	**Bobot Penilaian (%)**
		Indikator	**Kriteria & Bentuk**	**Luring (*offline*)**	**Daring (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1	Being able to understand the concepts and zones of generation, propagation, and mitigation of a tsunami wave	Students can explain the concepts and zones of generation, propagation, and mitigation of a tsunami wave	**Kriteria:** Non-test **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning, Discussion, Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Three zones of a tsunami wave: generation, propagation, and mitigation **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.* **Materi:** Tsunami as a gravity surface wave in the ocean **Pustaka:** *Ward, S. N. 2011. Encyclopedia of Solid Earth Geophysics: Tsunami. Edited by Harsh K. Gupta. National Geophysical Research Institute (NGRI). Council 52 of Scientific and Industrial Research (CSIR). Dordrecht, Netherlands: Springer, pp. 1-1539. e-ISBN: 978-90-481-8702-7.*	2%

2	Being able to understand possible tsunami sources of earthquake, submarine landslide, and volcanic eruption origin	Students can explain possible tsunami sources of earthquake, submarine landslide, and volcanic eruption origin	**Kriteria:** Description on student assignments: 1. Some useful mathematical derivations (by a group) 2. Thematic poster (by a group) 3. Individual presentation on the relevant poster **Bentuk Penilaian** : Aktifitas Partisipasif, Penilaian Hasil Project / Penilaian Produk, Praktik / Unjuk Kerja	Contextual Learning, Discussion, Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Different major tsunami sources: earthquakes, submarine landslides, and volcanic eruptions **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.* **Materi:** Examples of a combined source of tsunami excitation **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	3%

3	Being able to understand possible tsunami sources of earthquake, submarine landslide, and volcanic eruption origin	Students can explain possible tsunami sources of earthquake, submarine landslide, and volcanic eruption origin	**Kriteria:** Description on student assignments: 1. Some useful mathematical derivations (by a group) 2. Thematic poster (by a group) 3. Individual presentation on the relevant poster **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning, Discussion, Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Different major tsunami sources: earthquakes, submarine landslides, and volcanic eruptions **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.* **Materi:** Examples of a combined source of tsunami excitation **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	3%
4	Being able to derive the long wave speed of a nondispersive tsunami in the homogenous open ocean with no bottom deformation on the basis of shallow-water approximation	Students can derive the long wave speed of a non-dispersive tsunami in the homogenous open ocean with no bottom deformation on the basis of shallow-water approximation	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Non-dispersive tsunamis, Shallow-water approximation, Long wave speed **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	3%

5	Being able to derive the long wave speed of a nondispersive tsunami in the homogenous open ocean with no bottom deformation on the basis of shallow-water approximation	Students can derive the long wave speed of a non-dispersive tsunami in the homogenous open ocean with no bottom deformation on the basis of shallow-water approximation	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Non-dispersive tsunamis, Shallow-water approximation, Long wave speed **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	3%
6	Being able to derive the wave speed of a dispersive tsunami during propagation on the basis of deep-water approximation	Students can derive the wave speed of a dispersive tsunami during propagation on the basis of deep-water approximation	**Kriteria:** Non-test **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Dispersive tsunamis, Deep-water approximation, Corresponding wave speed **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	3%
7	Being able to derive the wave speed of a dispersive tsunami during propagation on the basis of deep-water approximation	Students can derive the wave speed of a dispersive tsunami during propagation on the basis of deep-water approximation	**Kriteria:** Assignment 1: handed in Criteria for assessment are available **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Dispersive tsunamis, Deep-water approximation, Corresponding wave speed **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	4%
8	Mid Semester Exam	penilaian mid semester	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Penilaian Hasil Project / Penilaian Produk	Mid Semester Exam 100 menit	Mid Semester Exam 100 menit	**Materi:** UTS **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	20%

9	Being able to derive the wave speeds of a tsunami during propagation due to the separate effects of ocean floor deformation and ocean water compressibility	Students can derive the wave speeds of a tsunami during propagation due to the separate effects of ocean floor deformation and ocean water compressibility	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning, Discussion, Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Varying tsunami speed with internal and external factors, Effect of ocean bottom topography, Effect of ocean water compressibility **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	4%
10	Being able to derive the wave speeds of a tsunami during propagation due to the separate effects of ocean floor deformation and ocean water compressibility	Students can derive the wave speeds of a tsunami during propagation due to the separate effects of ocean floor deformation and ocean water compressibility	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning, Discussion, Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Varying tsunami speed with internal and external factors, Effect of ocean bottom topography, Effect of ocean water compressibility **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	4%
11	Being able to understand the concepts of tsunami onset time, travel time, arrival time, and time delay	Students can understand the concepts of tsunami onset time, travel time, arrival time, and time delay	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Tsunami onset time, Tsunami travel time, Tsunami arrival time, Tsunami time delay **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	5%

12	Being able to understand the concepts of tsunami wave height, tsunami run-up, Green's law, and horizontal inundation	Students can understand the concepts of tsunami wave height, tsunami run-up, Green's law, and horizontal inundation	**Kriteria:** Assignment 2 (thematic poster): handed in Criteria for assessment are available **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Estimates of tsunami wave height, Tsunami run-up Green's law, Horizontal inundation **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	4%
13	Being able to understand the concepts of tsunami wave height, tsunami run-up, Green's law, and horizontal inundation	Students can understand the concepts of tsunami wave height, tsunami run-up, Green's law, and horizontal inundation	**Kriteria:** Menyelesaikan tugas dengan tepat waktu **Bentuk Penilaian** : Aktifitas Partisipasif	Contextual Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Estimates of tsunami wave height, Tsunami run-up Green's law, Horizontal inundation **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	4%
14	Being able to create a thematic poster relevant to tsunami hazard mitigation study and present it on the basis of video clip presentation	Students can create a thematic poster relevant to tsunami hazard mitigation study and present it on the basis of video clip presentation	**Kriteria:** Assignment 3 (relevant clips): handed in Criteria for assessment are available **Bentuk Penilaian** : Aktifitas Partisipasif	Poster Presentation for Project-Based Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Poster Presentation on Tsunami Hazard Mitigation Study (with students being active for class presentation) **Pustaka:** *Some power point files and/or course materials relevant to tsunami hazard study from the internet.*	4%

15	Being able to create a thematic poster relevant to tsunami hazard mitigation study and present it on the basis of video clip presentation	Students can create a thematic poster relevant to tsunami hazard mitigation study and present it on the basis of video clip presentation	**Kriteria:** Student assignment 3 (relevant clips): handed in Criteria for assessment are available **Bentuk Penilaian** : Aktifitas Partisipasif	Poster Presentation for Project-Based Learning Discussion Q & A 2 X 50	Kuliah tatap muka maya dengan google meet 2 x 50	**Materi:** Poster Presentation on Tsunami Hazard Mitigation Study (with students being active for class presentation) **Pustaka:** *Some power point files and/or course materials relevant to tsunami hazard study from the internet.*	4%
16	Final Exam	Final Exam	**Kriteria:** Final Exam **Bentuk Penilaian** : Penilaian Hasil Project / Penilaian Produk	Final Exam 100 menit	Final Exam 100 menit	**Materi:** Final Exam **Pustaka:** *Levin, B. W. and Nosov, M. A. 2016. Physics of Tsunamis. 2nd Edition. Heidelberg, Germany: Springer, pp. 1-388. eISBN: 978-3-319-24037-4.*	30%

Rekap Persentase Evaluasi : Project Based Learning

No	Evaluasi	Persentase
1.	Aktifitas Partisipasif	48%
2.	Penilaian Hasil Project / Penilaian Produk	51%
3.	Praktik / Unjuk Kerja	1%
		100%

Catatan

1. **Capaian Pembelajaran Lulusan Prodi (CPL - Prodi)** adalah kemampuan yang dimiliki oleh setiap lulusan prodi yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-Prodi) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CPMK Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kreteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yg setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. TM=Tatap Muka, PT=Penugasan terstruktur, BM=Belajar mandiri.

RPS ini telah divalidasi pada tanggal 11 Juni 2024

Koordinator Program Studi S1 Fisika

Prof. Dr. Munasir, S.Si., M.Si.
NIDN 0017116901

UPM Program Studi S1 Fisika

Dr. Diah Hari Kusumawati, S.Si., M.Si.
NIDN 0018047302

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