COURSE
PORTFOLIO

BACHELOR OF PHYSICS EDUCATION
UNIVERSITAS NEGERI JAKARTA

COURSE PORTFOLIO

Computational Physics

Academic Year – 2022/2023

Program Learning Outcomes

PLO 1 Demonstrate a religious manner, uphold values of humanity and nationalism, and internalize the value of self-reliance, discipline, responsible, critical thinking, innovative, communicative, and collaborative in solving different problems.

PLO 2 They are competent to work in team and independent, documented and analyse data to discover scientific assertions that correspond with standard scientific principles, communicate verbally and in writing, publish the paper, as well as supervise and assess to establish accurate solutions.

PLO 3 They are advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts.

PLO 4 They are qualified to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses.

PLO 5 They are capable to demonstrate by involve the fundamental principles of physical measurement and scientific methodology to interpret data and formulate physics phenomena.

PLO 6 They have acquired instrumentation and computational expertise in physics, synthesize and characterize material to expand it to another field.

PLO 7 They have advanced their knowledge in technology that using physics principle and employ physical concept to applied to relevant subject by utilize the development of science and technology in accordance with the field of work.

PLO 8 They are competent to improve their knowledge and continue study to a higher level.

Course Learning Objectives

CLO 1	Students possess the capability to transform scientific inquiries into mathematical equations and subsequently evaluate inaccuracies through the utilization of these modeling assumptions.
CLO 2	Students possess the capacity to conceptualize and analyze nonlinear equations, subsequently devising algorithms to explore potential solutions for the roots of equations. Furthermore, they are capable of employing these algorithms to tackle physics and scientific problems.
CLO 3	Students possess the capacity to conceptualize and generalize the complexities inherent in linear equation systems, thereby enabling them to effectively employ these concepts in the resolution of physics and scientific quandaries.
CLO 4	Students possess the capacity to engage in the analysis, collection, and representation of data by employing techniques such as interpolation and linear regression. These methodologies can be effectively utilized in the resolution of physics and scientific problems.
CLO 5	Students can abstract differential and integral problems numerically to solve questions of physics and science.
CLO 6	Students can identify physics and science issues that apply the principle of optimization to produce solutions.
CLO 7	Students can model and analyze ordinary differential equations with numerical methods.
CLO 8	Students can model and analyze the problem of partial differential equations with numerical methods.

Lecturer:

1. Dr.rer.nat. Bambang Heru Iswanto, M.Si.
2. Dewi Muliyati, M.Si., M.Sc.

Mapping Course Learning Outcome (CO) and Program Learning Outcome (PLO)

Program Learning Outcome (PLO) →	PLO 3 They are advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts.	PLO 4 They are qualified to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses.
Course Learning Outcome (CLO) ↓		
CLO 1 Students possess the capability to transform scientific inquiries into mathematical equations and subsequently evaluate inaccuracies through the utilization of these modeling assumptions.		Assignment 1

CLO 2 Students possess the capacity to conceptualize and analyze nonlinear equations, subsequently devising algorithms to explore potential solutions for the roots of equations. Furthermore, they can employ these algorithms to tackle physics and scientific problems.	Assignment 2	Midterm Test
CLO 3 Students possess the capacity to conceptualize and generalize the complexities inherent in linear equation systems, thereby enabling them to effectively employ these concepts in the resolution of physics and scientific quandaries.	Assignment 3 Project 1	Assignment 3 Project 1 Midterm Test
CLO 4 Students possess the capacity to engage in the analysis, collection, and representation of data by employing techniques such as interpolation and linear regression. These methodologies can be effectively utilized in the resolution of physics and scientific problems.	Project 2	Project 2 Midterm Test
CLO 5 Students can abstract differential and integral problems numerically to solve questions of physics and science.	Assignment 4 Assignment 5	Assignment 4 Assignment 5 Final Test
CLO 6 Students can identify physics and science issues that apply the principle of optimization to produce solutions.	Assignment 6	Assignment 6
CLO 7 Students can model and analyze ordinary differential equations with numerical methods.	Project 3	Project 3 Final Test
CLO 8 Students can model and analyze the problem of partial differential equations with numerical methods.	Project 4	Project 4

Forms of Assessment

Assignment	25%
Project	55%
Project-1	10%
Project-2	15%
Project-3	15%
Project-4	15%
Midterm Test	10%
Final Test	10%
Total	100%

Outcomes Assessment

No.	Name	Assignment	Project 1	Project 2	Project 3	Project 4	Midterm Test	Final Test	Final Score	Grade
1	A	67	87	72	75	80	25	30	65.03	B-
2	B	82	85	71	65	73	58	60	72.15	B
3	C	82	85	80	75	73	41	61	73.36	B
4	D	79	85	75	75	73	50	41	70.80	B
5	E	82	85	76	70	73	18	60	69.62	B-
6	F	84	87	73	75	80	51	72	76.18	B+
7	G	82	85	73	75	73	26	35	68.22	B-
8	H	82	85	86	75	73	21	74	73.53	B
9	I	82	86	87	75	93	35	61	76.92	A-
10	J	82	85	87	75	73	31	61	73.29	B
11	K	82	84	71	75	73	31	58	70.59	B
12	L	82	84	76	70	73	25	53	69.55	B-
13	M	82	85	73	65	73	31	57	69.42	B-
14	N	82	86	64	65	73	16	68	67.84	B-
15	O	82	85	78	70	73	26	62	70.91	B
16	P	68	85	74	75	80	31	55	68.40	B-

17	Q	86	87	71	75	87	36	27	71.43	B
18	R	82	85	80	75	73	24	61	71.69	B
19	S	82	85	77	70	73	18	25	66.22	B-
20	T	80	84	81	80	80	42	27	71.30	B
21	U	84	87	72	75	80	31	41	70.81	B
22	V	82	85	64	65	80	28	51	68.15	B-
23	W	88	87	83	80	80	41	60	77.23	A-
24	X	82	87	66	65	73	26	48	67.13	B-
25	Y	82	85	66	65	73	26	64	68.50	B-
26	Z	88	86	83	80	93	46	80	81.55	A-
27	AA	82	84	79	75	73	18	71	71.73	B
28	AB	82	84	72	65	73	31	62	69.59	B-
29	AC	82	85	76	75	73	53	65	74.39	B
30	AD	88	87	84	80	73	74	59	79.45	A-
31	AE	84	86	86	70	73	50	55	74.47	B
32	AF	80	85	76	70	80	28	56	70.89	B
33	AG	82	86	86	75	80	23	58	73.30	B
34	AH	82	85	81	70	73	49	67	74.25	B

Calculation of Weight per PLO

Form of Assessment	Weight	Weight per PLO		Total	Total Weight	
		PLO 3	PLO 4		PLO 3	PLO 4
Assignment	0.25	0.5	0.5	1.0	0.125	0.125
Project	0.55	0.5	0.5	1.0	0.275	0.275
Midterm Test	0.10	0.0	1.0	1.0	0.000	0.100
Final Test	0.10	0.0	1.0	1.0	0.000	0.100
Total	1.00				0.4	0.6

Example of PLO Calculation

No.	Name	Assignment	Project 1	Project 2	Project 3	Project 4	Midterm Test	Final Test	Final Score	Grade
9	I	82	86	87	75	93	35	61	76.92	A-

Project student with name I = 85.04

No.	Name	PLO 3	PLO 4
9	I	(82*0.125+85.04*0.275+35*0+61*0)/0.4 = 83.93	(82*0.125+85.04*0.275+35*0.1+61*0.1)/0.6 = 72.09

PLO Assessment Rubric

PLO	Performance Criteria	Excellent (E)	Good (G)	Satisfy (S)	Fail (F)
3	Possess the advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts.	Have the advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts with a score of at least 80.	Have the advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts with a score of at least 70 and less than 80.	Have the advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts with a score of at least 55 and less than 70.	Have the advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts with a score of less than 55.
4	Possess the qualification to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses.	Possess the qualification to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses with a score of at least 80.	Possess the qualification to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses with a score of at least 70 and less than 80.	Possess the qualification to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses with a score of at least 55 and less than 70.	Possess the qualification to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses with a score of less than 55.

Example of PLO Predicates for Each Student

No.	Name	Assignment	Project	Midterm Test	Final Test	PLO 3	PLO 4
9	I	82	85.04	35	61	83.93 Excellent	72.09 Good

PLO Predicates for All Students

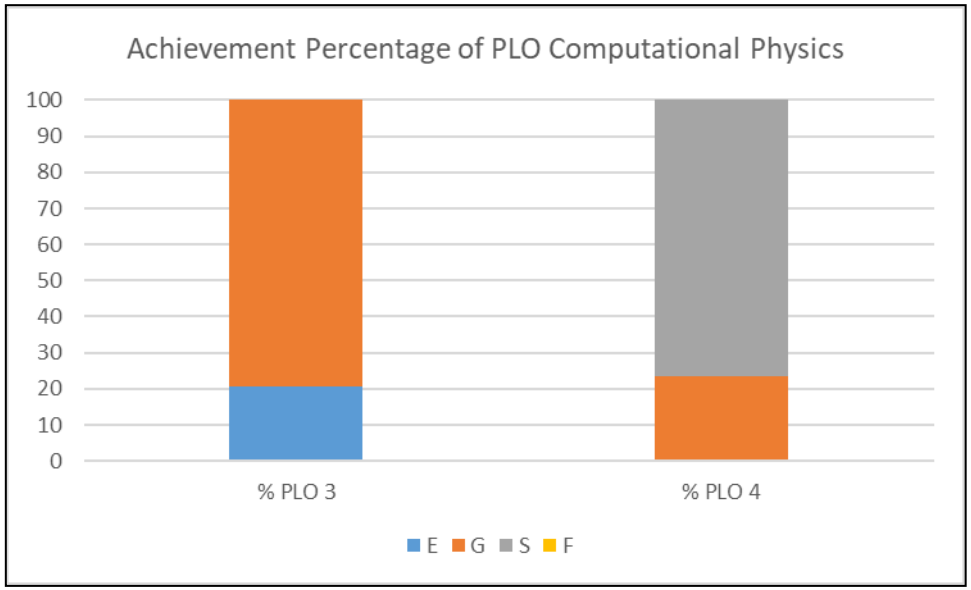
No	Name	Assignment	Project	Midterm Test	Final Test	Final Score	Grade	PLO 3 Score	PLO 4 Score	PLO 3 Predicates	PLO 4 Predicates
1	A	67.00	77.77	25.00	30.00	65.03	B-	74.21	58.77	G	S
2	B	82.00	72.45	58.00	60.00	72.15	B	75.26	69.96	G	S
3	C	82.00	77.57	41.00	61.00	73.36	B	78.76	69.64	G	S
4	D	79.17	76.20	50.00	41.00	70.80	B	76.94	66.59	G	S
5	E	81.67	75.27	18.00	60.00	69.62	B-	77.08	64.51	G	S
6	F	83.83	78.05	51.00	72.00	76.18	B+	79.66	73.74	G	G
7	G	81.83	75.75	26.00	35.00	68.22	B-	77.46	61.93	G	S
8	H	81.50	79.36	21.00	74.00	73.53	B	79.83	69.19	G	S
9	I	82.17	85.05	35.00	61.00	76.92	A-	83.93	72.10	E	G
10	J	81.50	79.48	31.00	61.00	73.29	B	79.91	68.74	G	S
11	K	82.00	74.89	31.00	58.00	70.59	B	76.92	66.24	G	S
12	L	81.83	75.07	25.00	53.00	69.55	B-	76.99	64.45	G	S
13	M	81.83	73.02	31.00	57.00	69.42	B-	75.59	65.18	G	S
14	N	82.00	70.80	16.00	68.00	67.84	B-	74.12	63.53	G	S
15	O	81.83	75.73	26.00	62.00	70.91	B	77.45	66.42	G	S
16	P	67.83	77.89	31.00	55.00	68.40	B-	74.55	64.16	G	S
17	Q	85.67	79.48	36.00	27.00	71.43	B	81.21	64.77	E	S
18	R	82.17	77.55	24.00	61.00	71.69	B	78.80	66.83	G	S
19	S	81.83	75.39	18.00	25.00	66.22	B-	77.21	58.77	G	S

20	T	79.67	80.89	42.00	27.00	71.30	B	80.30	65.17	E	S
21	U	83.50	77.70	31.00	41.00	70.81	B	79.32	65.01	G	S
22	V	81.67	72.43	28.00	51.00	68.15	B-	75.14	63.38	G	S
23	W	87.83	82.14	41.00	60.00	77.23	A-	83.71	72.78	E	G
24	X	82.00	71.32	26.00	48.00	67.13	B-	74.48	62.10	G	S
25	Y	81.83	70.98	26.00	64.00	68.50	B-	74.19	64.58	G	S
26	Z	87.67	85.52	46.00	80.00	81.55	A-	85.98	78.46	E	G
27	AA	81.83	77.05	18.00	71.00	71.73	B	78.35	67.19	G	S
28	AB	81.67	72.50	31.00	62.00	69.59	B-	75.18	65.74	G	S
29	AC	82.00	76.52	53.00	65.00	74.39	B	78.04	71.82	G	G
30	AD	87.83	80.34	74.00	59.00	79.45	A-	82.48	77.29	E	G
31	AE	84.33	77.98	50.00	55.00	74.47	B	79.77	70.81	G	G
32	AF	80.17	77.18	28.00	56.00	70.89	B	77.92	66.08	G	S
33	AG	82.00	81.27	23.00	58.00	73.30	B	81.30	67.83	E	S
34	AH	82.00	76.64	49.00	67.00	74.25	B	78.12	71.54	G	G

Percentage PLO Achievements

	Predicate	PLO 3	PLO 4
%	E	21	0
%	G	79	24
%	S	0	76
%	F	0	0
	Total	100	100

Achievement Percentage of PLO Computational Physics



Appendix

Assignment-1	Physics and Science Modeling
Assignment-2	Root of Equations
Assignment-3	Linear Algebraic Equation
Assignment-4	Numerical Differentiation
Assignment-5	Numerical Integration
Assignment-6	Optimization
Project-1	Compare Linear Algebraic Equation
Project-2	Predict data using Interpolation and Curve Fitting
Project-3	Solve Physical Problem using Ordinary Differential Equations
Project-4	Solve Physical Problem using Partial Differential Equations

Scoring for Assignment

No	Indicators	Weight (%)	Score			
			0	1	2	3
1	Writing the problem formula.	10				
2	Modeling mathematical equations.	10				
3	Writing algorithms.	10				
4	Writing the source code.	25				
5	Analysing the results of the simulation.	25				
6	Answering questions.	20				

$$\text{Assignment Score} = \frac{\sum \text{Weight} \times \text{Score}}{3}$$

SCORING FOR TEAM PROJECT

No	Indicators	Weight (%)	Score			
			1	2	3	4
Preparation Stage						
1	Project Design	5				
2	References	5				
Implementation Stage						
1	Five steps of Programming	5				
2	Material and multimedia identification	5				
3	Identify libarary selection	10				
4	Simulation characters and applications	10				
5	Methods of simulation and computational accuracy testing	10				
Sourcecode						
1	Sourcode running well	10				
2	Sourcecode multi-problem	15				
Final Stage						
1	History Commit	5				
2	Presentation	20				

$$\text{Project Score} = \frac{\sum \text{Weight} \times \text{Score}}{4}$$

KEMENTERIAN RISET DAN PENDIDIKAN TINGGI
UNIVERSITAS NEGERI JAKARTA

FAKULTAS MIPA
PROGRAM STUDI FISIKA - PENDIDIKAN FISIKA

MIDTERM TEST

COMPUTATIONAL PHYSICS (3 SKS)

Tanggal	:	15 June 2023
Waktu	:	100 minutes
Perangkat yang dibolehkan	:	Open book, Scientific Calculator
Dosen	:	Dr. B. Heru Iswanto, M.Si Handjoko Permana, M.Si Dewi Muliyati, M.Sc

Working Instructions:

- Do the questions manually on the answer sheet.
- Write down the name, NIM, course, and lecturer.
- Do the problems with a ballpoint.
- Calculation results are sufficient up to 4 decimal places.
- The results of cheating / cooperation will be given a value of ZERO.

1. (25 Points). The industry produces three components: K1, K2, and K3. To produce a K1 component, four kg of copper, one kg of zinc, and two kg of nickel are required. For K2, you need three kg of copper, three kg of zinc, and one kg of nickel. Meanwhile, K3 requires two kg of copper, one kg of zinc, and three kg of nickel, as shown in the following table:

Components	Copper	Zinc	Nickel
K1	4	1	2
K2	3	3	1
K3	2	1	3

   Use the numerical method that you are good at to determine how many K1, K2, and K3 components can be produced optimally if the total materials available are 960 kg of copper, 510 kg of zinc, and 610 kg of nickel.
2. (25 points) The following is the result of measuring the concentration of oxygen in seawater according to the measured temperature.

T (°C)	16	24	32	40
ρ (mg/L)	9.870	8.418	7.305	6.413

   Calculate the approximate value of the oxygen concentration at 27°C using the polynomial interpolation method that you are good at.

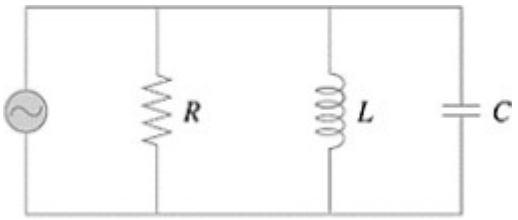
3. (25 points) Measurement of speed (v) and force (F) on wind turbines obtained the following data:

v (m/s)	10	20	30	40	50	60	70	80
F (N)	25	70	380	550	610	1220	830	1450

   a. From these data perform linear regression to model the relationship F and v.
   b. Make a data plot and a graph of the regression function that you get.
   c. B How big is the correlation between the two variables? please.

4. (25 points) In the following RLC circuit, the circuit impedance is:

$$\frac{1}{Z} = \sqrt{\frac{1}{R^2} + \left(\omega C - \frac{1}{\omega L}\right)^2}$$



Where Z is the impedance (Ω) and ω the corner frequency (rad/s). If R = 225 Ω, C = 0.6 μF, and L = 0.5 H, determine the value of ω so that Z = 75 Ω. Use a closed numerical method with an initial guess value of ω = 1.0 and 1000, and the stopping criterion ε_{stop} = 0.1%.

No	Answer	Score
1	Define variables and mathematical models Copper: 960 Zinc: 510 Nickel: 610 mathematical models $4k_1 + 3k_2 + 2k_3 = 960$ $k_1 + 3k_2 + k_3 = 510$ $2k_1 + k_2 + 3k_3 = 610$ Equation in matrix form: $[A][X] = [B]$ $\begin{matrix} 4 & 3 & 2 \\ [1 & 3 & 1] \\ 2 & 1 & 3 \end{matrix} \begin{matrix} k_1 \\ [k_2] \\ k_3 \end{matrix} = \begin{matrix} 960 \\ [510] \\ 610 \end{matrix}$	10
	Students can choose the method that is mastered. The other methods are still assessed, for this case, the solution matrices converge to the same value.	15
	Using the inverse matrix [A]= 4 3 2 / 1 3 1 / 2 1 3; [B]= 960 / 510 / 610 [A]-1= 0.421053 -0.36842 -0.15789 / -0.05263 0.421053 -0.10526 / -0.26316 0.105263 0.473684; {K}= 120 / 100 / 90 Using Gauss Elimination method [[4. 3. 2.] [0. −9. −2.] [2. 1. 3.]] [960. −1080. 610.] [[4. 3. 2.] [0. −9. −2.] [0. 1. −4.]] [[4. 3. 2.] [0. −9. −2.] [0. 0. −38.]] [960. −1080. −3420.] The value of k1 is: 120 The value of k2 is: 100	

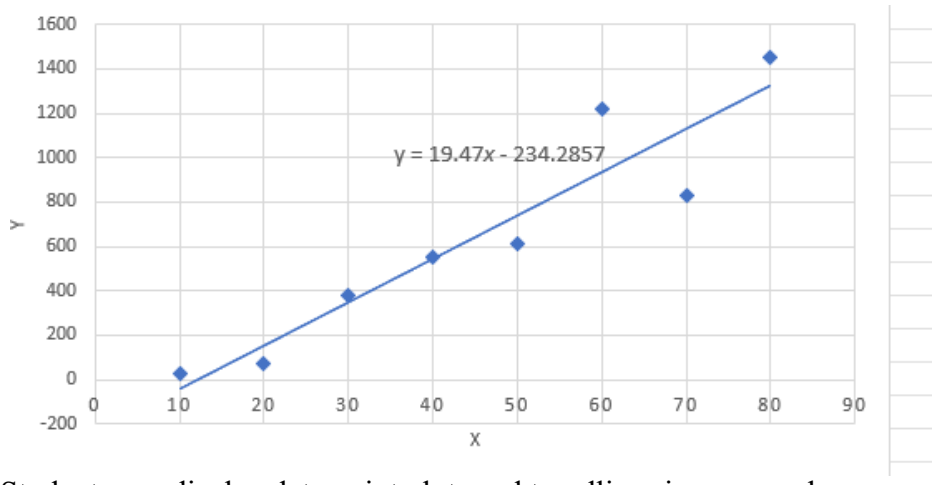
No	Answer	Score
	The value of k3 is: 90	
2	Students can choose a method that is mastered, this is exemplified by the Newton interpolation method. Using Newton's interpolation method The difference table is divided	15

Interpolasi Newton				
T (degreess C)	16	24	32	40
ρ (mg/L)	9.87	8.418	7.305	6.413
target to estimate the value of ρ at T = 27 degrees C				
Table for Newton's divisible differences				
xi	f(xi)	f[x1, x2]	f[x1,x2,x3]	f[x1,x2,x3,x4]
24	8.418	-0.139125	0.002648438	-3.84115E-05
32	7.305	-0.1603125	0.002033854	
16	9.87	-0.1440417		
40	6.413			
f(27) orde-3	7.967236328			

	For orde-3: $f(x) = f(x_0) + \cdots + (x - x_0) \ldots (x - x_2) f[x_3, x_2, x_1, x_0]$ $f(27) = 8.418 + (27 - 24)(-0.139125)$ $+ (27 - 24)(27 - 32)(0.00264844) + (27 - 24)(27$ $- 32)(27 - 16)(-3.84115E - 05)$ $f(27) = 7.967236328$ Other polynomial methods are still assessed with pay attention to the decimal number displayed.	10
3	3a. Linear regression equation For linear regression, we tabulate the data using $v = x$; $F = y$	10

x	y	x^2	xy
10	25	100	250
20	70	400	1400
30	380	900	11400
40	550	1600	22000
50	610	2500	30500
60	1220	3600	73200
70	830	4900	58100
80	1450	6400	116000
$\Sigma = 360$	$\Sigma = 5135$	$\Sigma = 20400$	$\Sigma = 312850$

$y = a_0 + a_1 x$
$n = 8$

No	Answer	Score
	$a_0 = \dfrac{\frac{1}{n}\Sigma y \Sigma x^2 - \frac{1}{n}\Sigma x \Sigma xy}{\Sigma x^2 - \frac{1}{n}(\Sigma x)^2}$ $a_0 = \dfrac{\frac{1}{8}(5135)(20400) - \frac{1}{8}(360)(312850)}{20400 - \frac{1}{8}(360)^2}$ $= -234.2857$ $a_1 = \dfrac{\Sigma xy - \frac{1}{n}\Sigma x \Sigma y}{\Sigma x^2 - \frac{1}{n}(\Sigma x)^2}$ $a_1 = \dfrac{312850 - \frac{1}{8}(360)(5135)}{20400 - \frac{1}{8}(360)^2}$ $= 19.47$ Then, $y = a_0 + a_1 x$ $y = -234.2857 + 19.47\ x$ $y = 19.47x - 234.2857$	
	3b. Plot the data and Graph the regression function  Students can display data point plots and trendlines in one graph.	10
	3c. Correlation F and v	5

No	Answer	Score

Regression Statistics	
Multiple R	0.97368
R Square	0.948053
Adjusted R Square	0.939396
Standard Error	0.15325
Observations	8

ANOVA

	df	SS	MS	F	gnificance F
Regression	1	2.57173	2.57173	109.5031	4.47E-05
Residual	6	0.140913	0.023485		
Total	7	2.712643			

	Coefficients	tandard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	pper 95.0%
Intercept	-0.56203	0.303644	-1.85096	0.113639	-1.30502	0.180958	-1.30502	0.180958
log x	1.984176	0.189613	10.46437	4.47E-05	1.520211	2.448141	1.520211	2.448141

Correlation value (excel), $r^2 = 0.948053$

or by manual calculation

$y = a_2 x^{\beta 2}$

$log_{10} y = log_{10} a_2 + \beta_2 \log x$

$v = x; F = y$

$\log_{10} y = -0.56203 + 1.984176\, log_{10} x$

$log_{10} a_2 = -0.56203$

$\beta_2 = 1.9843$

$log_{10} a_2 = -0.56203$

$a_2 = 10^{-0.56203}$

$y = a_2 x^{\beta 2}$

$= 0.27414 x^{1.9843}$

$F = 0.27414 v^{1.9843}$

$r^2 = 0.9481$

			Score
4	Students can choose one of the closed methods. In clear questions, interval limits are given. Closed methods that can be chosen are bisection and falsi rule. In this rubric, it is exemplified if using the bisection method.		

f(x)	(1/75)-sqrt((1/225^2)+(omega*0.6*1e-6-1/(omega*0.5))^2)=0							
iteratio	xa	xb	xc	f(xc)	error (%)	f(xa)	f(xb)	f(xa)*f(xc)<0?
1	1	1000	500.5	0.007553081		-1.98667	0.008674	1
2	1	500.5	250.75	0.004333698	99.6012	-1.98667	0.007553	1
3	1	250.75	125.875	-0.003092624	99.20556	-1.98667	0.004334	0
4	125.875	250.75	188.3125	0.001924393	33.15632	-0.00309	0.004334	1
5	125.875	188.3125	157.0938	-6.24395E-05	19.87269	-0.00309	0.001924	0
6	157.0938	188.3125	172.7031	0.001025883	9.03827	-6.2E-05	0.001924	1
7	157.0938	172.7031	164.8984	0.000508837	4.733027	-6.2E-05	0.001026	1
8	157.0938	164.8984	160.9961	0.000230473	2.423875	-6.2E-05	0.000509	1
9	157.0938	160.9961	159.0449	8.59028E-05	1.226806	-6.2E-05	0.00023	1
10	157.0938	159.0449	158.0693	1.22119E-05	0.617189	-6.2E-05	8.59E-05	1
11	157.0938	158.0693	157.5815	-2.49926E-05	0.30955	-6.2E-05	1.22E-05	0
12	157.5815	158.0693	157.8254	-6.3602E-06	0.154536	-2.5E-05	1.22E-05	0
13	157.8254	158.0693	157.9474	2.93337E-06	0.077208	-6.4E-06	1.22E-05	1

25

No	Answer	Score
	Students can show the root value or omega value = 157.9 and the relative error value is less than 0.1%. The table above may have a different arrangement and/or sequence, the most important thing is that the table determines xc and the error value.	

KEMENTERIAN RISET DAN PENDIDIKAN TINGGI
UNIVERSITAS NEGERI JAKARTA

FAKULTAS MIPA
PROGRAM STUDI PENDIDIKAN FISIKA

Building Future Leaders

FINAL TEST

COMPUTATIONAL PHYSICS (3 SKS)

Tanggal	:	15 June 2023
Waktu	:	100 minutes
Perangkat yang dibolehkan	:	Open book, Scientific Calculator
Dosen	:	Dr. B. Heru Iswanto, M.Si Handjoko Permana, M.Si Dewi Muliyati, M.Sc

Working Instructions:

- Do the questions manually on the answer sheet.
- Write down the name, NIM, course, and lecturer.
- Do the problems with a ballpoint.
- Calculation results are sufficient up to 4 decimal places.
- The results of cheating / cooperation will be given a value of ZERO.

1. (35 point) **Numerical Integral.** The work done by an isothermally expanding gas can be calculated by the equation:

$$W = \int P \, dV$$

where P and V are the pressure and volume of the gas. If the measurement results for the pressure and volume of the gas are as shown in the following table, calculate the work done by the gas (in kJ) using a combination of the trapezoidal rule, Simpson's 1⁄3 rule, and Simpson's 3⁄8 rule.

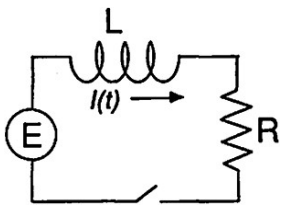
$P\ (kPa)$	336	294.4	266.4	260.8	260.5	249.6	193.6	165.6
$V\ (m^3)$	0.5	2	3	4	6	8	10	11

2. (30 point) **Numerical Differential:** The following is data on the distance traveled by the rocket (y) against time (t):

$t\ (s)$	0	25	50	75	100	125
$y\ (km)$	0	32	58	78	92	100

Use numerical differentiation to estimate the velocity and acceleration of the rocket over time.

3. (35 point) **Ordinary Differential Equations**: A circuit like the one in the figure has inductance L = 50 H, resisteance R = 20 Ohm, and voltage source $E = 10 \sin(t)$ Volt. At t = 0 no electric current flows, $I(0) = 0$. When the switch is closed, a current will flow of I(t) according to the equation:



$$L\frac{dI}{dt} + R\,I = E$$

a. Calculate the electric current at t=0.3s using the 2nd order Runge-Kutta method with h = 0.1.
b. Calculate the error from the calculation results.

Openbook exam system, the answers must be in accordance with the instructions, especially in using numerical methods

1. Max: 35 point

$P\ (kPa)$	336	294.4	266.4	260.8	260.5	249.6	193.6	165.6
$V\ (m^3)$	0.5	2	3	4	6	8	10	11
Subnumeric for easy correcting students are not required to use this.	1	2	3	4	5	6	7	8

$$W = \int P\ dV$$

Applying the trapezoidal method to calculate integration on Volume (v_1 and v_2) and Volume (v_7 and v_8). $I_1 = (V_2 - V_1)\dfrac{P_1 + P_2}{2} = (2 - 0.5)\dfrac{336 + 294.4}{2} = 472.8$ $I_4 = (V_8 - V_7)\dfrac{P_8 + P_7}{2} = (11 - 10)\dfrac{19.6 + 165.5}{2} = 179.55$	Score: 10 point
Applying the Simpson method 1/3 on $v_2, v_3, and\ v_4$ $I_2 = (4 - 2)\dfrac{V_2 + 4V_3 + V_4}{6} = \dfrac{294.4 + 4(266.4) + 260.8}{3} = 540.27$	Score: 10 point
Applying the Simpson method 3/8 on $v_4, v_5, v_6\ and\ v_7$ $I_3 = (10 - 4)\dfrac{V_4 + 3(V_5 + V_6) + V_7}{8} = \dfrac{3}{4}(260.8 + 3(260.5 + 249.6) + 193.6) = 1488.5$	Score: 10 point
The work value is the sum of all the integration parts $W = I_1 + I_2 + I_3 + I_4$ $W = 472.8 + 540.27 + 1488.5 + 179.55 = 2681.12\ kJ$	Score: 5 Point

If student answers using the trapezoidal method but completes all parts of the integration, he will still be assessed with a maximum of 15 points.

2. Max: 30 Point

Table data

$t\ (s)$	0	25	50	75	100	125
$y\ (km)$	0	32	58	78	92	100

The main objective of this problem is to determine the value of velocity and acceleration for each time according to table data using numerical differentiation. Time in seconds; Distance in kilometers

Step-1 Difference forward to estimate the speed at $t_0 = 0$ $f'(t_0) = \frac{-f(t_{i+2}) + 4f((t_{i+1})) - 3f(t_i)}{2h}$ With i = 0 $f'(t_0) = \frac{-f(t_2) + 4f(t_1) - 3f(t_0)}{2h}$ $f(t_0) = 0; f(t_1) = 32; f(t_2) = 58; h = 25$ $f'(0) = \frac{-58 + 4 \times 32 - 3 \times 0}{50} = 1.4$ $v(t = 0) = 1.4\ km/s$ Step-2 Difference forward for acceleration $f''(t_i) = \frac{-f(t_{i+3}) + 4f(t_{i+2}) - 5f(t_{i+1}) + 2f(t_i)}{h^2}$ $i = 0; f(t_0) = 0; f(t_1) = 32; f(t_2) = 58; f(t_2) = 78; h = 25$ $f'' = \frac{-78 + 4 \times 58 - 5 \times 32 + 2 \times 0}{25^2} = 0.0096$ $a(t = 0) = -0.0096\ km/s^2$	Score: 5 Point
Step-3 Center difference for $t_1 = 25$, $f'(t_1) = \frac{f(t_2) - f(t_0)}{2h}$ $f(t_0) = 0; f(t_2) = 58; h = 25$ $f'(25) = \frac{58 - 0}{2 \times 25} = 1.16$ $v(t = 25) = 1.16\ km/s$ Step-4 Acceleration at $t_1 = 25$ $f''(t_1) = \frac{f(t_2) - 2f(t_1) + f(t_0)}{h^2}$ $f(t_0) = 0; f(t_2) = 58; f(t_1) = 32; h = 25$ $f''(25) = \frac{58 - 2 \times 32 + 0}{25^2} = -0.0096$ $a(t = 25) = -0.0096 km/s^2$ This step is repeated for t_2= 50, t_3= 75, and t_4= 100	Score: 15 Point
Step-5 The difference backwards for t_5= 125	Score: 5 Point

$$f'(t_5) = \frac{3f(t_5) - 4f(t_4) + f(t_3)}{2h}$$

$f(t_3) = 78; f(t_4) = 92; f(t_5) = 100; h = 25$

$$f'(125) = \frac{3 \times 100 - 4 \times 92 + 78}{50} = 0.2$$

$v(t = 125) = 0.20\ km/s$

Step-6

$$f''(t_3) = \frac{2f(t_5) - 5f(t_4) + 4f(t_3) - f(t_2)}{h^2}$$

$f(t_3) = 78; f(t_4) = 92; f(t_5) = 100; f(t_2) = 58; h = 2$

$$f''(125) = \frac{2 \times 100 - 5 \times 92 + 4 \times 78 - 58}{(25)^2} = -0.0096$$

$a(t = 125) = -0.0096\ km/s^2$

velocity and acceleration data every time

Score: 5 Point

t	y	v	a
0	0	1.4	-0.0096
25	32	1.16	-0.0096
50	58	0.92	-0.0096
75	78	0.68	-0.0096
100	92	0.44	-0.0096
125	100	0.20	-0.0096

3. Max: 35 Point

$$L\frac{dl}{dt} + R\ I = E$$

$L = 50\ H; R = 20\ ohm; E = 10\sin(t)\ Volt$

At t = 0 there is no electric current flowing, $I(0) = 0$

a. Calculate the electric current at $t = 0.3\ s$ using the Runge-Kutta method of order-2 with h = 0.1
   Runge Kutta order-2 Heun method: scan files part 1 and part 2 = 35 points. Students may also use the Ralston method, with similar steps
   If anyone answers analytically, 5 points are given.
b. Calculate the error from the calculation results. (this section if anyone answers is given an additional 3 poin

COURSE PORTFOLIO

Mathematical Physics II
Academic Year – 2022/2023

Program Learning Outcomes

PLO 1 Demonstrate a professional attitude in work based on religious values, human values and culture.
PLO 2 Demonstrate an attitude of critical thinking, innovative, collaborative and communicative in solving problems in the field of physics education.
PLO 3 Able to comprehend concepts in classical and modern physics.
PLO 4 Involve mathematical, computational, and measurement protocols in order to solve the physics problem.
PLO 5 Capable to implement pedagogical content knowledge technology (TPACK) in advancing, implementing and evaluating physics learning.
PLO 6 Capable to utilize fundamental principle and applied physics, identify problem, discover alternative solutions based on theory and research, construct-ed and implemented in physics education research.
PLO 7 Capable of conducting education, management of physics laboratory, and practicum in accordance with the HSE (Health Safety and Environment) principle.
PLO 8 Capable to enhancing another related competence with applied physics.

Course Learning Objectives

CLO 1: Understand the concept of scalar and vector field.
CLO 2: Understand the periodic function and its applications.
CLO 3: Seek for the solution of partial differential equation with appropriate boundary conditions.
CLO 4: Understand the functions of complex variables and their applications.

Lectures: Dr. Teguh Budi Prayitno, M.Si.
Prof. Dr. Mangasi A. Marapung
Prof. I Made Astra, M.Si

Mapping Course Learning Outcome (CO) and Program Learning Outcome (PLO)

Program Learning Outcome / Course Outcome	PLO 3: They are advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical and computational concepts.	PLO 4: They are qualified to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models or simulations that correspond to hypotheses
CLO 1: Understand the concept of scalar and vector field.	Assignment	-
CLO 2: Understand the periodic function and its applications.	-	Case-based Learning
CLO 3: Seek for the solution of partial differential equation with appropriate boundary conditions.	Midterm Exam	-
CLO 4: Understand the functions of complex variables and their applications.	-	Final Exam

Forms of Assessment

Assignment	= 10%
Case-based Learning	= 50%
Midterm Exam	= 20%
Final Exam	= 20%
Total	= 100%

	PLO 3	PLO 4
Assignment	50%	50%
Case-based Learning	50%	50%
Midterm Exam	50%	50%
Final Exam	50%	50%

Outcomes Assessment

No	Name	Assignment	Case-based Learning	Midterm Exam	Final Exam	final score	Grade
1	A	80	80	41	45	65.2	**C+**
2	B	90	90	47	57	74.8	**B**
3	C	95	95	60	63	81.6	**A-**
4	D	90	90	60	45	75	**B**
5	E	85	90	36	68	74.3	**B**
6	F	95	90	49	70	78.3	**B+**
7	G	90	90	39	65	74.8	**B**
8	H	95	90	43	68	76.7	**B+**
9	I	95	95	59	68	82.4	**A-**
10	J	95	95	46	68	79.8	**B+**
11	K	95	90	66	68	81.3	**A-**
12	L	80	85	46	68	73.3	**B**
13	M	95	90	48	65	77.1	**B+**
14	N	95	85	44	72	75.2	**B+**
15	O	95	90	46	68	77.3	**B+**
16	P	98	85	44	57	72.5	**B**
17	Q	98	80	39	50	67.6	**B-**
18	R	96	90	46	65	76.8	**B+**
19	S	95	90	46	68	77.3	**B+**
20	T	90	85	44	40	68.3	**B-**
21	U	95	90	33	76	76.3	**B+**
22	V	95	90	43	75	78.1	**B+**
23	W	85	85	29	75	71.8	**B**

24	X	60	75	39	68	64.9	**C+**
25	Y	95	90	54	60	77.3	**B+**
26	Z	95	95	62	79	85.2	**A**
27	AA	90	90	51	68	77.8	**B+**
28	AB	75	85	31	65	69.2	**B-**
29	AC	80	95	39	68	76.9	**B+**
30	AD	98	95	57	53	75.5	**B+**
31	AE	98	96	56	68	80.48	**A-**
32	AF	90	90	16	60	60.8	**C+**
33	AG	90	95	61	58	76.25	**B+**
34	AH	95	95	61	68	81.25	**A-**

Calculation of Weight per PLO

Form of Assessment	Weight	Weight per PLO		Total	Total Weight	
		PLO 3	PLO 4		PLO 3	PLO 4
Assignment	0.10	0.50	0.50	1.00	0.05	0.05
Case-based Learning	0.50	0.50	0.50	1.00	0.25	0.25
Midterm Exam	0.20	0.50	0.50	1.00	0.10	0.10
Final Exam	0.20	0.50	0.50	1.00	0.10	0.10
Total	1.00	2.00	2.00	4.00	0.50	0.50

Example of PLO Calculation

No	Name	Assignment	Case-based Learning	Midterm Exam	Final Exam	Final Score and Grade	
1	Z	95	95	62	79	85.2	A

No	Name	PLO 3	PLO 4
1	Z	(95*0.05) + (95*0.25) + (62*0.1) + (79*0.1) / 0.50 = 85.2	(95*0.05) + (95*0.25) + (62*0.1) + (79*0.1) / 0.50 = 85.2

PLO Assessment Rubric

PLO	Performance Criteria	Excellent (E)	Good (G)	Satisfy (S)	Fail (F)
3	Employing advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical concepts.	Students are able to employ advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical concepts with a score of at least 80.	Students are able to employ advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical concepts with a score of at least 70 and less than 79.	Students are able to employ advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical concepts with a score of at least 56 and less than 69.	Students are able to employ advanced knowledge of relevant specialized classical theoretical physics and modern physics using mathematical concepts with a score of less than or equal 55
4	Accomplishing theoretical analysis by fundamental principles of physics and mathematical concepts to generate models correspond to hypotheses.	Students are able to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models correspond to hypotheses with a score of at least 80	Students are able to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models correspond to hypotheses with a score of at least 70 and less than 79.	Students are able to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models correspond to hypotheses with a score of at least 56 and less than 69.	Students are able to accomplish theoretical analysis by fundamental principles of physics and mathematical concepts to generate models correspond to hypotheses with a score of less than or equal 55

Example of PLO Predicates for Each Student

No	Name	PLO 3	PLO 4
1	Z	85.2 Excellent	85.2 Excellent

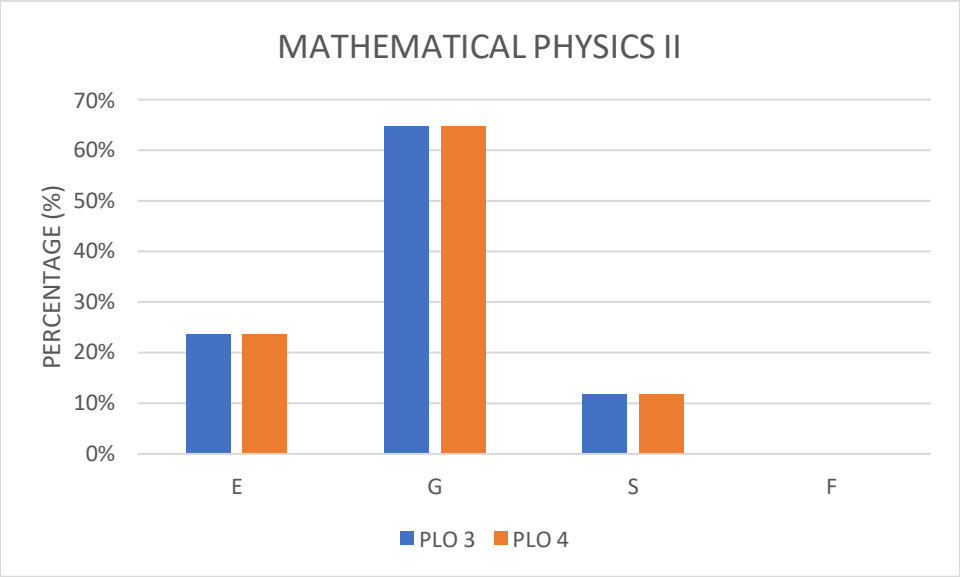
PLO Predicates for All Students

No	Name	final score	Grade	PLO 3	PLO 4
1	A	65.2	**C+**	**F**	**F**
2	B	74.8	**B**	**G**	**G**
3	C	81.6	**A-**	**E**	**E**
4	D	75	**B**	**G**	**G**
5	E	74.3	**B**	**G**	**G**
6	F	78.3	**B+**	**G**	**G**
7	G	74.8	**B**	**G**	**G**
8	H	76.7	**B+**	**G**	**G**
9	I	82.4	**A-**	**E**	**E**
10	J	79.8	**B+**	**G**	**G**
11	K	81.3	**A-**	**E**	**E**
12	L	73.3	**B**	**G**	**G**
13	M	77.1	**B+**	**G**	**G**
14	N	75.2	**B+**	**G**	**G**
15	O	77.3	**B+**	**G**	**G**
16	P	72.5	**B**	**G**	**G**
17	Q	67.6	**B-**	**F**	**F**
18	R	76.8	**B+**	**G**	**G**
19	S	77.3	**B+**	**G**	**G**
20	T	68.3	**B-**	**F**	**F**
21	U	76.3	**B+**	**G**	**G**
22	V	78.1	**B+**	**G**	**G**
23	W	71.8	**B**	**G**	**G**
24	X	64.9	**C+**	**F**	**F**
25	Y	77.3	**B+**	**G**	**G**
26	Z	85.2	**A**	**E**	**E**
27	AA	77.8	**B+**	**G**	**G**
28	AB	69.2	**B-**	**G**	**G**
29	AC	76.9	**B+**	**G**	**G**
30	AD	75.5	**B+**	**E**	**E**
31	AE	80.48	**A-**	**E**	**E**
32	AF	60.8	**C+**	**G**	**G**
33	AG	76.25	**B+**	**E**	**E**
34	AH	81.25	**A-**	**E**	**E**

Percentage PLO Achievements

Grade	PLO 3	PLO 8
E	8 (23.53%)	8
G	22 (64.71%)	22
S	4 (11.76 %)	4
F	0	0

Achievement Percentage of PLO



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS NEGERI JAKARTA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
PRODI PENDIDIKAN FISIKA
Kampus A UNJ Rawamangun, Gd. Hasjim Asj'arie Lt. 5
Jl. Rawamangun Muka No. 1 Jakarta 13220
Telp. 021-29266285/29266284

Mid-term Exam 118	
Mathematical Physics II	
Day/Date	**Monday, 27th March 2023**
Time	**10.00 - 11.40**
Study Program	**Physics Education**
Examination Format	**Closed Book**
Lecturers	**Prof. Dr. Mangasi A.M Dr. Teguh B. Prayitno Prof. I Made Astra, M.Si**

1. a. Find the area element dA of the polar coordinates using the Jacobian method
   b. Use the above polar coordinates to calculate the following integral:

$$\int_0^\infty \int_0^\infty e^{-\sqrt{x^2+y^2}}\, dx\, dy$$

2. Examine if the vector field $\vec{F} = z\hat{\imath} + x\hat{k}$ is conserved? If yes, find its appropriate scalar field

3. Calculate the integral $\int_C \vec{F}.d\vec{r}$ where C is the circle $x^2 + y^2 - 2 = 0$ from (1,1) to (1,-1) and $\vec{F} = (2x - 3y)\,\hat{\imath} - (3x - 2y)\,\mathbf{J}$

4. Plot the following function:

$$f(x) = \begin{cases} x, & 0 < x < 4 \\ 8 - x, & 4 < x < 8 \end{cases}$$

and use it to determine:

   a. Cosine Fourier series and plot it
   b. Sine Fourier series and plot it

** GOOD LUCK **

	KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET DAN TEKNOLOGI UNIVERSITAS NEGERI JAKARTA FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM **PRODI PENDIDIKAN FISIKA** Kampus A UNJ Rawamangun, Gd. Hasjim Asj'arie Lt. 5 Jl. Rawamangun Muka No. 1 Jakarta 13220 Telp. 021-29266285/29266284	**FINAL EXAM 118**	
		Mathematical Physics II	
		Hari/Tanggal	**Senin, 12th June 2023**
		Time	**10.00 - 11.40**
		Study Program	**Physics Education**
		Examination Format	**Closed Book**
		Lecturers	**Prof. Dr. Mangasi A.M** **Dr. Teguh B. Prayitno**

1. Consider the following function

$$f(t) = \begin{cases} \cos \omega_0 t, & |t| \leq a \\ 0, & |t| > a \end{cases}.$$

   a. Find the Fourier transformCari transformasi Fourier nya
   b. Draw the function f(t) as the function of t

2. Find the potential function of the rectangle 0≤ x ≤20 dan 0≤ y ≤40 if the top side is held at 110 volts while the other sides are grounded.

3. Determine if the function $u(x, y) = e^x \cos y$ is a harmonic function? If yes, formulate the complex function $f(z)$

4. Calculate the integral below along C, which is a circle with the radius 1 and counter-clock wise rotation

$$\oint_C \frac{z^6}{(2z-1)^6} dz$$

** GOOD LUCK **

COURSE PORTFOLIO

Introduction to Information Technology

Academic Year – 2022/2023

Program Learning Outcomes

PLO 1 Demonstrate a professional attitude in work based on religious values, human values and culture.
PLO 2 Demonstrate an attitude of critical thinking, innovative, collaborative and communicative in solving problems in the field of physics education.
PLO 3 Able to comprehend concepts in classical and modern physics.
PLO 4 Involve mathematical, computational, and measurement protocols in order to solve the physics problem.
PLO 5 Capable to implement pedagogical content knowledge technology (TPACK) in advancing, implementing and evaluating physics learning.
PLO 6 Capable to utilize fundamental principle and applied physics, identify problem, discover alternative solutions based on theory and research, construct-ed and implemented in physics education research.
PLO 7 Capable of conducting education, management of physics laboratory, and practicum in accordance with the HSE (Health Safety and Environment) principle.
PLO 8 Capable to enhancing another related competence with applied physics.

Course Learning Objectives

CLO 1	Understand Information Technology, Computer Systems, and Computer Operating Systems: their comprehensive understanding, trends, and developments.
CLO 2	Understand communications technologies and computer networking and multimedia technologies comprehensively and apply them to learn information technology further.
CLO 3	Understand artificial intelligence and big data technologies: their fundamentals and applications comprehensively and apply them to learn information technology further.
CLO 4	Understand the security and ethics concepts in the cyber world comprehensively and apply them to study information technology further.

Lecturer:

1. Dewi Muliyati, M.Si., M.Sc.

Mapping Course Learning Outcome (CO) and Program Learning Outcome (PLO)

Program Learning Outcome (PLO) →	PLO 4 Involve mathematical, computational, and measurement protocols in order to solve the physics problem.
Course Learning Outcome (CLO) ↓	
CLO 1 Understand Information Technology, Computer Systems, and Computer Operating Systems: their comprehensive understanding, trends, and developments.	Assignment 1 Assignment 2 Project 1 Midterm Test
CLO 2 Understand communications technologies and computer networking and multimedia technologies comprehensively and apply them to learn information technology further.	Assignment 3 Project 3 Project 4 Midterm Test
CLO 3 Understand artificial intelligence and big data technologies: their fundamentals and applications comprehensively and apply them to learn information technology further.	Assignment 4 Project 2 Final Test
CLO 4 Understand the security and ethics concepts in the cyber world comprehensively and apply them to study information technology further.	Final Test

Forms of Assessment

Assignment	25%
Project	55%
Project-1	10%
Project-2	15%
Project-3	15%
Project-4	15%
Midterm Test	10%
Final Test	10%
Total	100%

Outcomes Assessment

No.	Name	Assignment	Project 1	Project 2	Project 3	Project 4	Midterm Test	Final Test	Final Score	Grade
1	A	35	85	85	97	80	56	69	69.09	B-
2	B	82	87	81	90	60	76	65	78.05	B+
3	C	78	80	83	85	78	84	51	77.91	B+
4	D	63	85	81	85	55	78	40	69.10	B-

5	E	81	85	81	97	80	54	63	79.33	B+
6	F	84	85	92	85	85	88	68	84.28	A-
7	G	82	86	81	97	83	84	64	82.98	A-
8	H	83	85	87	80	85	88	47	80.42	A-
9	I	82	85	83	85	55	86	42	75.25	B+
10	J	82	86	81	97	83	82	59	82.35	A-
11	K	83	85	81	85	0	90	37	66.82	B-
12	L	82	87	79	85	63	78	35	74.61	B
13	M	63	86	84	97	83	64	51	75.46	B+
14	N	82	87	83	90	85	84	25	78.91	B+
15	O	82	87	81	85	63	92	47	77.38	B+
16	P	82	87	79	85	63	88	35	75.50	B+
17	Q	82	87	81	85	63	88	36	76.01	B+
18	R	83	85	87	85	85	94	64	83.53	A-
19	S	81	87	83	90	85	88	78	84.36	A-
20	T	82	86	81	97	83	86	55	82.28	A-
21	U	81	80	82	85	78	90	49	78.81	B+
22	V	82	80	80	85	78	90	43	78.33	B+
23	W	74	85	81	85	55	88	44	73.38	B
24	X	83	85	88	85	85	82	64	82.65	A-
25	Y	82	87	83	90	69	88	66	80.96	A-
26	Z	80	80	85	85	78	82	61	79.58	B+
27	AA	82	85	85	97	80	84	63	83.06	A-
28	AB	83	87	81	85	85	88	54	81.27	A-
29	AC	70	85	82	80	45	92	25	68.70	B-
30	AD	81	87	81	90	85	88	61	82.35	A-
31	AE	63	87	83	90	60	82	29	70.54	B
32	AF	80	85	82	80	45	90	49	73.50	B
33	AG	76	85	85	80	45	90	49	72.93	B
34	AH	82	85	87	85	85	68	64	80.81	A-
35	AI	82	85	81	97	80	84	57	81.77	A-

36	AJ	63	87	85	90	60	90	67	75.41	B+
37	AK	82	87	81	90	85	86	54	81.57	A-
38	AL	43	88	82	80	78	92	53	69.95	B-
39	AM	82	88	80	80	78	90	24	76.33	B+
40	AN	84	88	82	80	78	90	64	81.07	A-
41	AO	77	88	82	80	78	88	64	79.14	B+

Calculation of Weight per PLO

		Weight per PLO	Total	Total Weight
Form of Assessment	Weight	PLO 4		
Assignment	0.25	1.0	1.0	0.25
Project	0.55	1.0	1.0	0.55
Midterm Test	0.10	1.0	1.0	0.10
Final Test	0.10	1.0	1.0	0.10
Total	1.00			1.00

Example of PLO Calculation

No.	Name	Assignment	Project 1	Project 2	Project 3	Project 4	Midterm Test	Final Test	Final Score	Grade
6	F	84	85	92	85	85	88	68	84.28	A-

Project student with name F = 86.82

No.	Name	PLO 4
6	F	(84*0.25+86.82*0.55+88*0.1+68*0.1)/1.00 = 84.28

PLO Assessment Rubric

PLO	Performance Criteria	Excellent (E)	Good (G)	Satisfy (S)	Fail (F)
4	Involve mathematical, computational, and measurement protocols in order to solve the physics problem.	Involve mathematical, computational, and measurement protocols in order to solve the physics problem with a score of at least 80.	Involve mathematical, computational, and measurement protocols in order to solve the physics problem with a score of at least 70 and less than 80.	Involve mathematical, computational, and measurement protocols in order to solve the physics problem with a score of at least 55 and less than 70.	Involve mathematical, computational, and measurement protocols in order to solve the physics problem with a score of less than 55.

Example of PLO Predicates for Each Student

No.	Name	Assignment	Project	Midterm Test	Final Test	PLO 4
6	F	84	86.82	88	68	84.28 Excellent

PLO Predicates for All Students

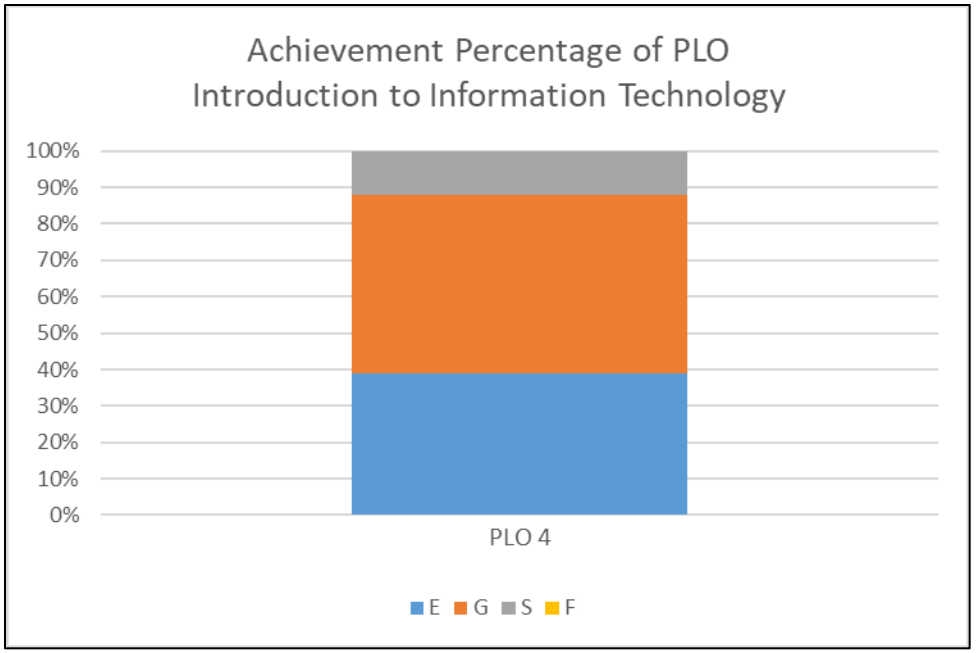
No.	Name	Assignment	Project	Midterm Test	Final Test	Final Score	Grade	PLO 4 Score	PLO 4 Predicates
1	A	35	86.82	56	69	69.09	B-	69.09	S
2	B	82	78.91	76	65	78.05	B+	78.05	G
3	C	78	81.73	84	50.75	77.91	B+	77.91	G
4	D	63	75.82	78	39.75	69.10	B-	69.10	S
5	E	81	85.91	54	63.25	79.33	B+	79.33	G
6	F	84	86.82	88	67.5	84.28	A-	84.28	E
7	G	82	86.73	84	64	82.98	A-	82.98	E
8	H	83	84.09	88	47	80.42	A-	80.42	E
9	I	82	76.27	86	41.5	75.25	B+	75.25	G
10	J	82	86.73	82	59	82.35	A-	82.35	E
11	K	83	60.82	90	37	66.82	B-	66.82	S
12	L	82	77.82	78	35.25	74.61	B	74.61	G
13	M	63	87.64	64	50.5	75.46	B+	75.46	G
14	N	82	86.18	84	25	78.91	B+	78.91	G
15	O	82	78.27	92	46.5	77.38	B+	77.38	G
16	P	82	77.82	88	34.75	75.50	B+	75.50	G
17	Q	82	78.27	88	35.5	76.01	B+	76.01	G
18	R	83	85.45	94	64	83.53	A-	83.53	E
19	S	81	86.18	88	78	84.36	A-	84.36	E
20	T	82	86.73	86	55	82.28	A-	82.28	E
21	U	81	81.27	90	48.75	78.81	B+	78.81	G
22	V	82	80.82	90	42.75	78.33	B+	78.33	G
23	W	74	75.82	88	43.5	73.38	B	73.38	G
24	X	83	85.91	82	64	82.65	A-	82.65	E
25	Y	82	81.82	88	65.5	80.96	A-	80.96	E
26	Z	80	82.18	82	60.75	79.58	B+	79.58	G
27	AA	82	86.82	84	63	83.06	A-	83.06	E
28	AB	83	84.36	88	54	81.27	A-	81.27	E
29	AC	70	71.91	92	25	68.70	B-	68.70	S

30	AD	81	85.73	88	61	82.35	A-	82.35	E
31	AE	63	79.36	82	28.75	70.54	B	70.54	G
32	AF	80	71.91	90	49	73.50	B	73.50	G
33	AG	76	72.82	90	49	72.93	B	72.93	G
34	AH	82	85.45	68	64	80.81	A-	80.81	E
35	AI	82	85.91	84	57	81.77	A-	81.77	E
36	AJ	63	79.82	90	67	75.41	B+	75.41	G
37	AK	82	85.73	86	54	81.57	A-	81.57	E
38	AL	43	81.36	92	52.5	69.95	B-	69.95	S
39	AM	82	80.91	90	23.5	76.33	B+	76.33	G
40	AN	84	81.36	90	64	81.07	A-	81.07	E
41	AO	77	81.36	88	64	79.14	B+	79.14	G

Percentage PLO Achievements

	Predicate	PLO 4
%	E	39
%	G	49
%	S	12
%	F	0
	Total	100

Achievement Percentage of PLO Computational Physics



Appendix

Assignment-1	Computer Hardware
Assignment-2	Logic Gate
Assignment-3	Signal Recognition
Assignment-4	Data Analytics
Project-1	Designing Computer for Specific Purpose
Project-2	ERD for Specific Information System
Project-3	Front-End Designing using HTML and CSS
Project-4	Designing Information System using CMS

COURSE PORTFOLIO

TEACHING SKILLS

Academic Year - 2022/2023

Program Learning Outcomes

PLO 1 Show a professional attitude in working based on religious values, human values, and culture.

PLO 2 Show critical, innovative, collaborative and communicative thinking in solving problems in the field of physics education.

PLO 3 Able to understand the concepts of classical and modern physics.

PLO 4 Engage math, computation, and measurement protocols to solve physics problems.

PLO 5 Able to implement technological pedagogical content knowledge (TPACK) in promoting, implementing, and evaluating physics learning.

PLO 6 Able to utilize the basic and applied principles of physics, identify problems, find alternative solutions based on theory and research, compile and implement in physics education research.

PLO 7 Able to carry out education, physics laboratory management, and practicum in accordance with K3LH (Health, Safety and Environment) principles.

PLO 8 Able to improve other competencies related to applied physics

Course Learning Objectives

CLO 1	Examine 21st century teaching skills and their implementation in physics learning.
CLO 2	Examine the display of opening and closing skills in physics learning.
CLO 3	Examine the display of questioning skills in physics learning.
CLO 4	Reviewing the display of reinforcement skills in physics learning.
CLO 5	Reviewing the display of skills to make variations in physics learning
CLO 6	Reviewing the display of explaining skills in physics learning.
CLO 7	Reviewing the display of skills in guiding group discussions in physics learning.
CLO 8	Examine the display of classroom management skills in physics learning.
CLO 9	Review the display of skills in conducting individual and small group approaches in classical learning.
CLO 10	Put the results of the study of the eight teaching skills into a micro lesson plan.
CLO 11	Implement the eight teaching skills in peer teaching practice.

Lecturer:

1. Hadi Nasbey, M.Si
2. Handjoko Permana, M.Si.
3. Fauzi Bakri, M.Si
4. Dwi Susanti, M.Pd

Mapping of Course Learning Outcomes (CO) and Program Learning Outcomes (PLO)

Program Learning Outcomes (PLO)	PLO 5 Able to implement pedagogical content knowledge technology (TPACK) in promoting, implementing, and evaluating physics learning.
Course Learning Outcomes (CLOs)	
CLO 1 Examine 21st century teaching skills and their implementation in physics learning.	Assignment 1 Lecturer Summary on 21st century teaching skills
CLO 2 Examine the display of opening and closing skills in physics learning.	Assignment 2 Making lesson plans refers to opening and closing skills
CLO 3 Reviewing the display of questioning skills in physics learning.	Assignment 3 Making lesson plans referring to questioning skills
CLO 4 Reviewing the display of reinforcement skills in physics learning.	Assignment 4 Making lesson plans referring to the skill of providing reinforcement
CLO 5 Reviewing the display of skills to make variations in physics learning	Assignment 5 Making lesson plans refers to opening and closing skills
CLO 6 Reviewing the display of explaining skills in physics learning.	Assignment 6 Making lesson plans refers to the skill of explaining
CLO 7 Reviewing the display of skills in guiding group discussions in physics learning.	Assignment 7 Making lesson plans referring to the skills of guiding group discussions
CLO 8	Assignment 8

Program Learning Outcomes (PLO) □	PLO 5 Able to implement pedagogical content knowledge technology (TPACK) in promoting, implementing, and evaluating physics learning.
Course Learning Outcomes (CLOs) □	
Examine the display of classroom management skills in physics learning.	Making lesson plans refers to classroom management skills
CLO 9 Review the display of skills in conducting individual and small group approaches in classical learning.	Project 1 Making lesson plan tools referring to the skills of conducting individual and small group approaches in classical learning
CLO 10 Put the results of the study of the eight teaching skills into a micro lesson plan.	Project 2 Making lesson plan devices refers to teaching skills in micro learning plans.
CLO 11 Implement the eight teaching skills in peer teaching practice.	Project 3 Making lesson plan devices refers to teaching skills in peer teaching practice.

Form of Assessment

	Assignment25% Project55%
Midterm Exam	10%
Final Test	10 %
Total	100%

Outcome Assessment

No.	Name	Assignment 1-8	Project 1	Project 2	Project 3	UTS	Final Test	Final Score	Grade
1	A	80	85	85	77	65	80	79.78	B+
2	B	82	86	86	72	76	85	81.33	A-
3	C	84	88	83	72	75	88	81.85	A-
4	D	84	88	85	82	88	85	85.05	A
5	E	86	88	80	72	65	87	80.70	A-
6	F	88	86	82	72	78	86	82.40	A-
7	G	82	86	84	77	80	80	81.78	A-
8	H	84	87	85	87	82	85	85.18	A
9	I	85	88	87	82	84	88	85.57	A
10	J	88	89	85	77	85	80	84.52	A-
11	K	88	90	86	72	85	85	84.47	A-
12	L	82	90	88	72	90	85	83.83	A-
13	M	83	85	90	87	78	88	85.38	A
14	N	83	80	88	75	90	90	83.30	A-
15	O	81	85	85	72	85	90	82.12	A-
16	P	85	87	80	72	87	90	82.77	A-

No.	Name	Assignment 1-8	Project 1	Project 2	Project 3	UTS	Final Test	Final Score	Grade
17	Q	78	86	76	72	67	88	77.90	B+
18	R	86	87	67	72	88	85	80.23	A-
19	S	78	88	78	82	90	90	82.97	A-
20	T	82	85	74	72	85	88	80.15	A-
21	U	83	86	77	77	80	90	81.75	A-
22	V	85	87	25	87	85	88	75.03	B+
23	W	88	88	10	87	80	88	72.72	B
24	X	82	90	78	72	75	84	80.40	A-
25	Y	84	90	82	72	75	82	81.43	A-
26	Z	85	87	50	87	75	88	78.62	B+
27	AA	88	88	77	72	80	90	82.45	A-
28	AB	78	86	50	87	70	88	76.18	B+
29	AC	76	85	28	87	65	86	70.77	B
30	AD	75	84	75	72	65	88	76.40	B+
31	AE	81	80	80	82	60	90	79.62	B+
32	AF	83	85	89	72	74	87	81.95	A-
33	AG	82	86	85	72	72	86	80.85	A-
34	AH	82	88	78	87	60	88	81.68	A-
35	AI	62	90	87	45	75	88	72.50	B
36	AJ	82	90	75	72	70	85	79.45	B+
37	AK	80	90	75	72	77	88	79.95	B+
38	AL	82	88	75	77	78	85	80.80	A-

Calculation of Weight per PLO

		Weight per PLO	Total	Total Weight
Form of Assessment	Weight	PLO 5		
Assignment	0.25	1.0	1.0	0.25
Project	0.55	1.0	1.0	0.55
Midterm Exam	0.10	1.0	1.0	0.10
Final Test	0.10	1.0	1.0	0.10
Total	1.00			1.00

PLO Calculation Example

No.	Name	Assignment 1-8	Project 1	Project 2	Project 3	Midterm Exam	Final Test	Final Score	Class
9	I	85	88	87	82	84	88	85.57	A

Project student with name I = 85.67

No.	Name	PLO 5
9	I	(85*0.25+85.67*0.55+84*0.1+88*0.1)/1.00 = 85.57

PLO Assessment Rubric

PLO	Performance Criteria	Very Good (E)	Good (G)	Satisfactory (S)	Failed (F)
5	Involves math, computation, and measurement protocols to solve physics problems.	Engage math, computation and measurement protocols to solve physics with a minimum score of 80.	Engage math, computation, and measurement protocols to solve physics with a score of at least 70 and less than 80.	Engage math, computation, and measurement protocols to solve physics with a score of at least 55 and less than 70.	Involves math, computation, and measurement protocols to solve physics with a score of less than 55.

Example of PLO Predicate for Each Student

No.	Name	Assignment	Project	Midterm Exam	Final Test	PLO 5
9	I	85	85.67	84	88	85.57 Very good

PLO Predicate for All Students

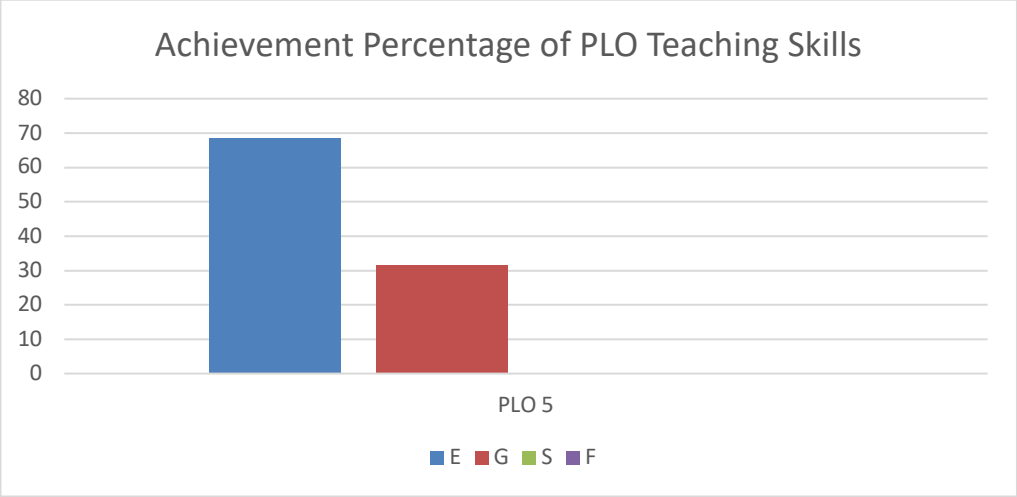
No.	Name	Assignment 1-8	Project 1	Project 2	Project 3	UTS	Final Test	Final Score	Class	PLO SCORE 5	PLO PREDICTION 5
1	A	80	85	85	77	65	80	79.78	B+	79.78	G
2	B	82	86	86	72	76	85	81.33	A-	81.33	E
3	C	84	88	83	72	75	88	81.85	A-	81.85	E
4	D	84	88	85	82	88	85	85.05	A	85.05	E
5	E	86	88	80	72	65	87	80.70	A-	80.70	E
6	F	88	86	82	72	78	86	82.40	A-	82.40	E
7	G	82	86	84	77	80	80	81.78	A-	81.78	E
8	H	84	87	85	87	82	85	85.18	A	85.18	E
9	I	85	88	87	82	84	88	85.57	A	85.57	E
10	J	88	89	85	77	85	80	84.52	A-	84.52	E
11	K	88	90	86	72	85	85	84.47	A-	84.47	E
12	L	82	90	88	72	90	85	83.83	A-	83.83	E
13	M	83	85	90	87	78	88	85.38	A	85.38	E
14	N	83	80	88	75	90	90	83.30	A-	83.30	E
15	O	81	85	85	72	85	90	82.12	A-	82.12	E
16	P	85	87	80	72	87	90	82.77	A-	82.77	E
17	Q	78	86	76	72	67	88	77.90	B+	77.90	G

No.	Name	Assignment 1-8	Project 1	Project 2	Project 3	UTS	Final Test	Final Score	Class	PLO SCORE 5	PLO PREDICTION 5
18	R	86	87	67	72	88	85	80.23	A-	80.23	E
19	S	78	88	78	82	90	90	82.97	A-	82.97	E
20	T	82	85	74	72	85	88	80.15	A-	80.15	E
21	U	83	86	77	77	80	90	81.75	A-	81.75	E
22	V	85	87	25	87	85	88	75.03	B+	75.03	G
23	W	88	88	10	87	80	88	72.72	B	72.72	G
24	X	82	90	78	72	75	84	80.40	A-	80.40	E
25	Y	84	90	82	72	75	82	81.43	A-	81.43	E
26	Z	85	87	50	87	75	88	78.62	B+	78.62	G
27	AA	88	88	77	72	80	90	82.45	A-	82.45	E
28	AB	78	86	50	87	70	88	76.18	B+	76.18	G
29	AC	76	85	28	87	65	86	70.77	B	70.77	G
30	AD	75	84	75	72	65	88	76.40	B+	76.40	G
31	AE	81	80	80	82	60	90	79.62	B+	79.62	G
32	AF	83	85	89	72	74	87	81.95	A-	81.95	E
33	AG	82	86	85	72	72	86	80.85	A-	80.85	E
34	AH	82	88	78	87	60	88	81.68	A-	81.68	E
35	AI	62	90	87	45	75	88	72.50	B	72.50	G
36	AJ	82	90	75	72	70	85	79.45	B+	79.45	G
37	AK	80	90	75	72	77	88	79.95	B+	79.95	G
38	AL	82	88	75	77	78	85	80.80	A-	80.80	E

Percentage of PLO Achievement

	Predicate	PLO 5
%	E	68.42
%	G	31.58
%	S	0.00
%	F	0.00

Percentage of PLO Achievement in Teaching Skills



Attachment

Assignment-1	Lecturer Summary on 21st century teaching skills
Assignment-2	Making lesson plans refers to opening and closing skills
Assignment-3	Making lesson plans referring to questioning skills
Assignment-4	Making lesson plans referring to the skill of providing reinforcement
Assignment-5	Making lesson plans refers to opening and closing skills
Assignment-6	Making lesson plans refers to the skill of explaining
Assignment-7	Making lesson plans referring to the skills of guiding group discussions
Assignment-8	Making lesson plans refers to classroom management skills
Project-1	Making lesson plan tools referring to the skills of conducting individual and small group approaches in classical learning
Project-2	Making lesson plan devices refers to teaching skills in micro learning plans.
Project-3	Making lesson plan devices refers to teaching skills in peer teaching practice.

Assessment for Assignment

No.	Indicator	Weight (%)	Score			
			0	1	2	3
1	Learning objectives	10				
2	Conformity with syllabus	10				
3	Clarity of lesson plan identity	10				
4	Depth and accuracy of material	25				
5	Adequacy of media sources and teaching materials	25				
6	Accuracy of the form of assessment instruments	20				

Assignment Value $= \frac{\Sigma bobot \times skor}{3}$

ASSESSMENT FOR TEAM PROJECTS

No.	Indicator	Weight (%)	Score			
			1	2	3	4
Preparation Stage						
1	RPP	5				
2	Teaching Materials and Media	5				
Implementation Stage						
1	Attitude	5				
2	21st century skills	5				
3	8 Teaching Skills	10				
4	Material Mastery	10				
Final Stage						
1	Assessment	5				
2	Assessment Rubric	20				

Project Value $= \frac{\sum \text{Weights} \times \text{Skor}}{4}$

MINISTRY OF RESEARCH AND HIGHER EDUCATION
JAKARTA STATE UNIVERSITY

FACULTY OF MIPA
PHYSICS EDUCATION STUDY PROGRAM

Building Future Leaders

MIDTERM EXAM

TEACHING SKILLS (3 CREDITS)

Date	:	June 15, 2023
Time	:	100 minutes
Allowed devices	:	Open book, Scientific Calculator
Lecturer	:	B. Heru Iswanto, M.Si Handjoko Permana, M.Si Dewi Muliyati, M.Sc

Work Instructions:

- Do the questions manually on the answer sheet.
- Write down your name, NIM, course, and lecturer.
- Do the questions using a ballpoint pen.
- FOR THE GROUP OF OBJECTIVE QUESTIONS, CHOOSE ONE ANSWER THAT YOU CONSIDER THE MOST CORRECT AND CROSS THE LETTER OF CHOICE ON THE ANSWER SHEET PROVIDED.
- ANSWER SHEETS MUST NOT BE OVERWRITTEN WITH LIQUID PROOFREADERS SUCH AS TIP-EX.

OBJECTIVE QUESTIONS

1. According to David Ausubel, in receptive learning and discovery learning, meaningful learning can occur if...
   A. Students discover knowledge
   B. Students memorize the material
   C. Students conduct experiments in the lab
   D. Students observe their learning environment
   E. Students incorporate material into taught cognitive structures

2. The component of learning activities that aims to link prior knowledge with new material that students will learn is referred to as:
   A. Exploration
   B. Perception
   C. Expository
   D. Reflection
   E. Conclusions

3. The statements relevant to the application of process skills in Physics learning are:
   (1) The nature of physics as a product, process, and value
   (2) The essence of learning is the process of teaching students
   (1) The nature of educating students is for the future
   (2) The nature of learning is the process of actively acquiring knowledge
   You think the correct statement is:
   A. 1 and 2
   B. 2 and 3
   C. 3 and 4
   D. 4 only

4. Some implications of constructivism for learning practices in schools are:
   (1) Teaching is helping students learn
   (2) Learning is the process of making meaning of new information
   (3) Learning is more emphasized on the process rather than the end result
   (4) Teaching is the transfer of knowledge from teacher to student
   You think the correct statement is:
   A. 1 and 2
   B. 2 and 3

C. 3 and 4
D. 4 only

5. One of the correct formulation of competency achievement indicators for GLBB subject matter is:
   A. Understand the concept of GLBB and its application in everyday life
   B. Determine displacement based on a graph of velocity as a function of time in GLBB
   C. Analyze graphs of velocity as a function of time and position as a function of time for GLBB
   D. Through discussion, students can explain the characteristics of GLBB based on the graph.
   E. Understand the relationship between displacement, velocity and acceleration for GLBB

6. Class X material on KD 3.3. It is stated that "Analyzing the magnitudes of physics in straight motion with constant speed and straight motion with constant acceleration. The coverage of the subject matter in accordance with the KD is:
   (1) GLB
   (2) Free Fall Motion
   (3) Vertical Upward Motion
   (4) Parabolic Motion
   A. 1 and 2
   B. 2 and 3
   C. 3 and 4
   D. 4 only

7. Physics learning that educates is conceptualized as learning that...
   A. Emphasizing instructional impact with the Tut Wuri Handayani principle
   B. Contain and generate instructional impact and character strengthening
   C. Using science, active, creative, effective, fun and innovative (PAKEMI) approach
   D. Contains the nature of science as a process, product and value

8. The core activities of learning include exploration, elaboration and confirmation. One example of teacher activity in elaboration is...
   A. Involve students in seeking broad and deep information about the topic/theme of the material to be studied.
   B. Facilitate interaction between students, between students and teachers, the environment and other learning resources.
   C. Provide opportunities for students to think, analyze, solve problems and act without fear.
   D. Providing positive feedback and reinforcement in the form of oral, written, gestures, and gifts to student successes.
   E. Formulate a concept with students after students have studied and analyzed the results of observation activities.

9. The core activities of learning include exploration, elaboration and confirmation. One example of teacher activity in exploration is...
   A. Involve students in seeking broad and deep information about the topic/theme of the material to be learned.
   B. Facilitate interaction between students, between students and teachers, the environment and other learning resources.
   C. Provide opportunities for students to think, analyze, solve problems and act without fear.
   D. Providing positive feedback and reinforcement in the form of oral, written, gestures, and gifts to student successes.
   E. Formulate a concept with students after students have reviewed and analyzed the results of observation activities.

10. The core activities of learning include exploration, elaboration and confirmation. One example of a teacher's activity in confirmation is...
    A. Involve students in seeking broad and deep information about the topic/theme of the material to be learned.

B. Facilitate interaction between students, between students and teachers, the environment and other learning resources.
C. Provide opportunities for students to think, analyze, solve problems and act without fear
D. Providing positive feedback and reinforcement in the form of oral, written, gestures, and gifts to student successes.
E. Formulate a concept with students after students have reviewed and analyzed the results of observation activities.

11. There are several types of teaching materials that can be developed by teachers in preparing their learning tools. Included in the teaching materials are....
A. Interactive learning multimedia
B. Audio, video, and movie compact disks
C. Audio cassettes, radios, vinyl records, and compact disks
D. Hand outs, books, modules, posters, brochures, LKS, photos or pictures
E. Video only

12. Professionally, teachers must have the courage to make decisions to modify the learning activities that have been prepared in the lesson plan. The decision can be made after the teacher gets feedback from the activity:
A. Perception
B. Exploration and elaboration
C. Confirmation and reflection
D. Initial concept exploration
E. Elaboration and confirmation

13. One of the principles of assessing student learning outcomes at the primary and secondary education levels is validity. This means:
A. Assessment is based on data that reflects the ability being measured.
B. Assessment covers all aspects of competence using a variety of appropriate assessment techniques
C. Assessment is an integral component of learning activities.
D. Assessment can be accounted for, both in terms of techniques, procedures, and results
E. Assessment is carried out with valid and reliable assessment tools

14. The components of the syllabus and lesson plans used in the development of student learning outcomes assessment instruments are
A. Core Competencies
B. Learning Indicators
C. Learning Activities
D. Competency Standard
E. Learning Objectives

15. There are several forms of questions used in a competency-based assessment system. One form of test question that is suitable for measuring a person's ability to perform certain tasks such as laboratory practice is:
A. Portfolio
B. Short description
C. Multiple choice
D. Performen
E. Structured essay

16. One example of the correct formulation of learning objectives for the subject matter of Archimedes' law is....
A. Through simple experiments and discussions, students can apply Archimedes' law to solve everyday problems related to static fluid.
B. After conducting a simple experiment, learners can understand Archimedes' law and its application in everyday life.
C. Investigate the factors that affect the magnitude of Archimedes' force and its application in everyday life.
D. Conduct an experiment on Archimedes' law to be able to explain floating, hovering and sinking objects.

E. After hearing the teacher's explanation, learners calculate the volume of objects immersed in liquid.

17. Educative physics learning is conceptualized as learning that...
    A. Contains and generates instructional impact as well as character strengthening
    B. Easy, fun, and enjoyable (GASING)
    C. Active, innovative, creative, and fun
    D. Implementing the nature of science as a process, product, and value
    E. Learning that must take place in the classroom and laboratory

18. The correct statement regarding the refinement of the 2013 curriculum formulation mindset is....
    (1) The SKLs are derived from the needs
    (2) Content Standards are derived from the SKL through subject-based KI.
    (3) All subjects must contribute to the formation of attitudes, skills and knowledge and are bound by core competencies in each class.
    (4) Subjects are derived from the competencies to be achieved. In your opinion, the correct statement is....
    A. 1 and 2
    B. 2 and 3
    C. 3 and 4
    D. 2,3, and 4
    E. 3only

19. One of the principles of the assessment approach in the 2013 curriculum is accountability, meaning...
    A. Assessment by educators is carried out in a planned manner, integrated with learning activities, and sustainable.
    B. Assessment covers all aspects of competence using a variety of appropriate assessment techniques
    C. Assessment with instruments that are in line with learning objectives and materials
    D. Assessments can be accounted for internally and externally to the school in terms of techniques, procedures, and results.
    E. Assessment that is based on standards and not influenced by the subjectivity of the assessor.

20. Focusing learners' attention on the material to be taught, by showing interesting objects, providing illustrations, reading news in newspapers, showing animated slides, natural phenomena, social phenomena, or others is an introductory step in learning at the ... stage.
    A. Providing references
    B. Apperception
    C. Motivation
    D. Orientation
    E. E. Attracts students' attention

21. The statement that corresponds to the purpose of implementing apperception activities in every lesson is....
    A. Prepare students to receive the learning that will be done on that day
    B. Knowing the new knowledge that learners already have
    C. Motivate learners to be ready to start learning
    D. Constructing new knowledge relevant to students' prior knowledge
    E. Review learners' prior knowledge related to new knowledge

22. The following are some of the teacher's activities in carrying out learning in the classroom
    (1) Adapt subject matter to learners' learning pace and ability
    (2) Encourage and respect learners to ask questions and express opinions
    (3) Adjust learners' seating arrangements to the purpose and characteristics of the learning process
    (4) The teacher provides reinforcement and feedback on students' responses and learning outcomes during the learning process.

    In your opinion, statements that include classroom management activities are....
    A. 1 and 2
    B. 2 and 3
    C. 3 and 4

D. 2, 3, and 4
E. 3 only

23. One learner asked about how the water tap works so that it can close the flow of water in the plumbing. Another learner asked how a tsunami earthquake occurs, and another learner asked how the days of the month are always different. These student questions provide an indicator that students...
    A. Caring about everyday physics problems
    B. Not understanding the previous learning material
    C. Critical of physics problems encountered
    D. Objectively look at physics problems
    E. Skeptical of answers from peers

24. In the implementation of the 2006 curriculum, Active, Creative, Innovative and Fun Learning (PAIKEM) is highly recommended because...
    A. Creativity in the application of physics concepts will emerge if students are under pressure to understand physics concepts.
    B. Physics material has more cognitive aspects
    C. Physics is a part of science learning to enhance students' creativity
    D. There is a relationship between learning motivation and learning outcomes of the material taught.
    E. Each physics material has its own characteristics and difficulty level.

25. A learner after asking about the lysatic current and getting an explanation from the teacher about the concept, he asks again about the concept of the origin of electric charge, about the current density, and so on related to what the teacher explained. The attitude of these students is the attitude of...
    A. Objective
    B. Honest
    C. Creative
    D. Skeptics
    E. On

26. To overcome the limited number of tools and to make learning in accordance with the nature of science at the end of the semester the teacher conducts learning activities in the laboratory, the teacher prepares several experiments with different materials and topics and is carried out in rotation. This practicum process supports the learning strategy with a hands-on approach...
    A. Verification
    B. Reification
    C. Exploration
    D. Diskoveri
    E. Inductive

27. Before starting the lesson on the law of conservation of energy, the teacher begins with a demonstration using a steam engine model to show the change of heat into motion. Such a teacher intends to address the following except....
    A. In order for the concepts related to the law of conservation of energy that students understand, students are convinced that the law of conservation of energy is true.
    B. When explaining the mathematical model, students recognized each role of the process symbol.
    C. To raise students' interest in making a steam medin for pounding rice
    D. To show the application of the material learned in everyday life
    E. In order for the phenomenon of the law of conservation of energy to be listened to and imagined by students
    F.

28. A teacher brought an old mineral water bottle, a straw, and small nails to make the oscillating motion of a straw pipe in water by weighting the bottom of the straw pipe with nails. Such a teacher utilizes...
    A. Utilize the environment for learning resources to understand concepts
    B. Used items become unique and valuable items with artistic value.
    C. Students' skills to model fishing hook pennants

D. Technology products in the environment as learning resources
E. Used items as tools for the workshop program

29. When teaching atomic theory, teachers try to find computer-based learning models to explain atomic theory models. Such a teacher has tried and tried to...
    A. Conduct ICT-based learning
    B. Teaching material can be understood as a whole even in the form of synthesis
    C. Following the trend of today's powerful learning models
    D. Learners can recognize how to learn physics using computers
    E. Learning is more real and less boring

30. In making physics worksheets, teachers generally assign presenting data in the form of graphs. The process skills that are trained to students are...
    A. Summarize
    B. Hypothesize
    C. Fact finding
    D. Communicating
    E. Analyzing

MINISTRY OF EDUCATION, CULTURE, RESEARCH AND TECHNOLOGY
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MINUTES OF VERIFICATION OF TEST QUESTIONS

I, as the Coordinator of the **Teaching Skills** Course in the Physics Education S-1 Program, declare that there has been a discussion of the teaching skills measurement instrument between the Coordinator Lecturer and the Subject
Parallel:

1. Day and Date of Discussion: Tuesday, May 17, 2022
2. Course Content: Teaching Skills
3. Number of measurement instruments: 1 question
   With the number of statement items: 7 items
4. Exam Time (Date, time, length of exam):

Adjusted to the study program course schedule

5. Coordination Meeting Participants:

No.	Lecturer Name	Signature
1	Prof. Dr. Nurudin, M.Ag (Microteaching Coordinator LP3M UNJ)	
2	Dr. Firmanul Catur Wibowo, M. Pd	

The measurement instrument has been validated, **verified** and in **accordance** with the competency objectives of the course and it has also been checked that the load / time allocation for the questions given is in **accordance** with the level of the questions given.
The linkage of each exam question with course competencies can be seen in the following table:

No.	Course Competencies (CPMK)	Exam Question Number Related to the Competency
1	Opening and closing skills for physics learning	1, 7, 8
2	Questioning skills in physics learning	6, 8
3	Reinforcement skills in physics learning	3, 5
4	Variation skills in physics learning	2, 4, 5
5	Explanation skills in physics learning	3, 5
6	Skills in leading group discussions in physics learning	3
7	Classroom management skills in physics learning	2, 4
8	Skills in conducting personal and small group approaches in classical learning in physics learning	2, 4

Notes:
The questions are in accordance with the CPMK with a moderate level of difficulty.

Jakarta, May 18, 2022
Physics Education Department

Course Coordinator

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TEACHING SKILLS ASSESSMENT FORMAT IN MICROTEACHING PRACTICE

No.	Activity Aspect	Value			
		1	2	3	4
1.	Ability to open lectures Descriptors: a. Attracts students' attention b. Generates motivation c. Give reference to learning materials that will be presented d. Make links between old and new learning materials				
2.	Attitude in the learning process Descriptors: a. Voice clarity b. Body movements do not distract students' attention c. Enthusiasm of appearance mimic d. Place position mobility				
3.	Mastery of learning materials (teaching materials) Descriptors: a. Learning materials are presented according to the planned steps b. Clarity in explaining the material c. Clarity in providing examples d. Reflects breadth of insight				
4.	Learning process Descriptors: a. Appropriateness of the use of strategies/methods with the subject matter b. Presentation of learning materials relevant to TPK c. Enthusiastic in responding and using responses d. Accuracy in time utilization				
5.	Using media Descriptors: a. Pay attention to the principles of using media types b. Accuracy when using c. Skills in operationalizing				

	d. Help improve the learning process				
6.	~~Evaluation~~ Descriptors: a. Use oral assessment relevant to the TPK b. Using writing assessment relevant to the TPK c. Uses various types of assessments relevant to the TPK d. Carry out the assessment in accordance with what is written on the SAP				
7.	Ability to close the lecture Descriptors: a. Review b. Providing opportunities to ask questions c. Assign co-curricular activities d. Inform the next material				