#### HCMC UNIVERSITY OF TECHNOLOGY AND EDUCATION Faculty of Electrical And Electronic Engineering

# Department of Industrial Electronics

# SYLLABUS

- 1. Course name: Machine Learning
- **2.** Course code: MALE321063
- **3.** Credits: 3 (3/0/6)

Duration: 15 weeks (45h main course and 90h self-study)

#### 4. Instructors:

- 1- Nguyen Thanh Hai, PhD
- 2- Nguyen Manh Hung, PhD
- 3- Ngo Quoc Cuong, MEng

## 5. Course conditions

Prerequisites: Programing Language Corequisites: Statistic Theory

## 6. Course description

This course provides students fundamental knowledge about pattern recognition and machine learning. This course introduces fundamental supervised and unsupervised learning algorithm as well as recommendation system.

#### 7. Course Goals

Goals	Goal description (This course provides students:)	
G1	Fundamental supervised and unsupervised learning algorithm	01 (H) 07 (M)
G2	An ability to identify, evaluate and analysis an regression/ classification system.	02 (M), 03 (M)
G3	An ability design an regression/ classification system.	10 (L) 11 (H)

\* Note: High: H; Medium: M; Low: L

# 8. Course Learning Outcomes (CLOs)

CLOs		<b>Description</b> (After completing this course, students can have:)	Outcome
	G1.1	Have knowledge about linear regression models	1,7
	G1.2	Have knowledge about non-linear regression models	1,7
G1	G1.3	Have knowledge about clustering problem	1,7
	G1.4	Have knowledge about dimensional reduction	1,7
	G1.5	Have knowledge about recommendation systems	1,7

	G2.1 Have ability to identify an image based recognition		2, 3
G2	G2.2	Have ability to evaluate and analysis an natural language based recognition	2, 3
	G3.1	Have ability to design an regression or classification system	10, 11
G3	G3.2	Have ability to validate and verify and an regression or classification sytems	10, 11

## 9. Study materials

## - Textbooks:

[1] Christopher M. Bishop, *Pattern Reconition and Machine Learning*, 2nd ed Springer, 2007.

## - References:

[2] Duda, Richard, Peter Hart, and David Stork. *Pattern Classification*. 2nd ed. New York, NY: Wiley-Interscience, 2000.

[3] Hastie, T., R. Tibshirani, and J. H. Friedman. *The Elements of Statistical Learning: Data Mining, Inference and Prediction*. New York, NY: Springer, 2001.

#### **10. Sudent Assessments**

- Grading points: 10

- Planning for students assessment is followed:

Туре	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
	Midterms				
Exam01	Short exercise	Begin/ end of each week	Short question in class	G1.1- G1.5	10
Exam02	Coding exercise	week 11	Individual paper assessment in class	G2.1- G2.2,	20
Exam03	Project report	week 15	Individual paper assessment in class	G3.1, G3.3,	20
	Final exam				50
Final Exam	Final report	week 16	Project report	G1.1- G1.5 G2.1- G2.2	

#### **11. Course details:**

Weeks	Contents	CLOs
1	<i>Chapter 1: &lt;</i> Machine Learning Introduction> (3/0/6)	

Contents:       1.1 Machine learning introduction       1.2 Unsupervised learning       G1.1         1.3 Supervised learning       G1.1         1.3 Supervised learning       G1.1         Teaching methods:       + Theoretical lectures         + Questions       G1.1         B/ Self-study contents: (6)       G1.1         + Interpretation methods       G1.1         A/ Contents and teaching methods: (3)       G1.1         Contents:       2.1 Linear regression         2.1 Linear regression       G1.1         2.2 Object function       G1.1         2.3 Optimization       G1.1         Teaching methods:       +         + Theoretical lectures       +         + Questions       G1.1         B/ Self-study contents: (6)       +         + Object function derivative       G1.1         + Exercises       G1.1         A/ Contents and teaching methods:(3)       G1.1         Contents:       2.4 Multivariable problems       G1.1         2.6 Optimal multivariable function       G1.1         3       Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)         A/ Contents and teaching methods:(3)       G1.1         2.6 Optimal multivariable function       G1.1			
1.2 Unsupervised learning     G1.1       1.3 Supervised learning     Teaching methods:       + Theoretical lectures     +       + Questions     G1.1       B/Self-study contents: (6)     G1.1       + Inductive methods     G1.1       A/ Contents and teaching methods: (3)     G1.1       Contents     2.1 Linear regression     G1.1       2.1 Linear regression     2.2 Object function     G1.1       2.3 Optimization     G1.1       Teaching methods:     +       + Theoretical lectures     +       - Questions     G1.1       B/Self-study contents: (6)     G1.1       - Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)     G1.1       A/Contents and teaching methods: (3)     G1.1       Contents:     2.4 Multivariable problems       - 2.5 Multivariable problems     2.5 Multivariable features       - 2.4 Multivariable features     2.5 Multivariable features       - 2.6 Optimal multivariable function     G1.1       3     Teaching methods:       + Theoretical lectures     +       - Questions     G1.1		Contents:	
1.2 Unsupervised learning     G1.1       1.3 Supervised learning     Teaching methods:       + Theoretical lectures     +       + Questions     G1.1       B/Self-study contents: (6)     G1.1       + Inductive methods     G1.1       A/ Contents and teaching methods: (3)     G1.1       Contents     2.1 Linear regression     G1.1       2.1 Linear regression     2.2 Object function     G1.1       2.3 Optimization     G1.1       Teaching methods:     +       + Theoretical lectures     +       - Questions     G1.1       B/Self-study contents: (6)     G1.1       - Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)     G1.1       A/Contents and teaching methods: (3)     G1.1       Contents:     2.4 Multivariable problems       - 2.5 Multivariable problems     2.5 Multivariable features       - 2.4 Multivariable features     2.5 Multivariable features       - 2.6 Optimal multivariable function     G1.1       3     Teaching methods:       + Theoretical lectures     +       - Questions     G1.1		1.1 Machine learning introduction	
1.3 Supervised learning       Image: Teaching methods:       Image: Supervised learning         Teaching methods:       + Theoretical lectures       -         # Questions       B/ Self-study contents: (6)       -         # Inductive methods       G1.1         * Inductive methods       G1.1         * Inductive methods       G1.1         * Inductive methods       G1.1         * Inductive methods:       (3)         Contents:       2.1 Linear regression         2.2 Object function       G1.1         2.3 Optimization       G1.1         Teaching methods:       +         + Theoretical lectures       +         + Questions       G1.1         B/ Self-study contents: (6)       +         + Object function derivative       +         + Exercises       G1.1         A/ Contents and teaching methods:(3)       G1.1         A/ Contents and teaching methods:(3)       G1.1         Contents:       2.4 Multivariable problems         2.5 Multivariable features       G1.1         3       Contents:       -         3       Teaching methods:       +         + Theoretical lectures       +       Questions         B/ Self- study conte		-	<b>C</b> 1.1
Teaching methods:       +         +       Theoretical lectures         +       Questions         B/Self-study contents: (6)       G1.1         +       Interpretation methods         -       Interpretation methods         -       Interpretation methods         -       Interpretation methods         -       Chapter 2: < LINEAR REGRESSION > (6/0/12)         A/ Contents and teaching methods: (3)       G1.1         2       Contents:         2.1 Linear regression       G1.1         2.3 Optimization       G1.1         2.3 Optimization       G1.1         Teaching methods:       +         +       Theoretical lectures         +       Questions         B/Self-study contents: (6)       G1.1         +       Exercises         Contents and teaching methods:(3)       G1.1         A/ Contents and teaching methods:(3)       G1.1         3       Contents:       2.5 Multivariable problems         2.5 Multivariable founction       G1.1         3       Teaching methods:       F1         +       Theoretical lectures       G1.1         2.6 Optimal multivariable function       G1.1			G1.1
+ Theoretical lectures         + Questions         B/Self-study contents: (6)         + Interpretation methods         + Inductive methods         G1.1         A/Contents and teaching methods: (3)         Contents:         2.1 Linear regression         2.2 Object function         2.1 Linear regression         2.2 Object function         2.3 Optimization         Teaching methods:         + Theoretical lectures         + Questions         B/Self-study contents: (6)         + Object function derivative         + Exercises         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)         A/Contents and teaching methods: (3)         Contents:         2.3 Optimization         G1.1         2.4 Multivariable problems         2.5 Multivariable features         2.6 Optimal multivariable function         Teaching methods:         + Theoretical lectures         + Questions         G1.1         2.6 Optimal multivariable function         Teaching methods:         + Theoretical lectures         + Questions         B/Self-study contents: (6)         + Standard equation		1.3 Supervised learning	
+ Questions       B/Self-study contents: (6)       G1.1         + Interpretation methods       G1.1         + Inductive methods       G1.1         Chapter 2: < LINEAR REGRESSION > (6/0/12)       A/ Contents and teaching methods: (3)         Contents:       2.1 Linear regression         2.2 Object function       G1.1         2.3 Optimization       G1.1         Teaching methods:       +         + Theoretical lectures       +         + Questions       G1.1         B/Self-study contents: (6)       G1.1         + Exercises       G1.1         Contents:       2.4 Multivariable problems         2.5 Multivariable features       G1.1         3       Contents:         2.4 Multivariable features       G1.1         2.5 Multivariable features       G1.1         3       Contents:         2.4 Multivariable features       G1.1         2.6 Optimal multivariable function       G1.1         3       Feaching methods:         + Theoretical lectures       G1.1         + Theoretical lectures       G1.1         + Theoretical lectures       G1.1         * Questions       G1.1		Teaching methods:	
B' Self-study contents: (6)       Finterpretation methods       G1.1         + Inductive methods       G1.1         * Inductive methods       G1.1         Chapter 2: < LINEAR REGRESSION > (6/0/12)       A/ Contents and teaching methods: (3)         Contents:       2.1 Linear regression         2.2 Object function       G1.1         2.3 Optimization       G1.1         Teaching methods:       + Theoretical lectures         + Questions       G1.1         B' Self-study contents: (6)       G1.1         + Object function derivative       G1.1         + Exercises       G1.1         Contents:       2.3 University (6/0/12)         A' Contents and teaching methods: (3)       G1.1         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)       G1.1         A' Contents and teaching methods: (3)       G1.1         Contents:       2.4 Multivariable problems       G1.1         2.5 Multivariable features       G1.1         2.6 Optimal multivariable function       G1.1         Teaching methods:       + Theoretical lectures         + Questions       G1.1         B' Self- study contents: (6)       F1.1		+ Theoretical lectures	
+ Interpretation methods       G1.1         + Inductive methods       G1.1         + Inductive methods       G1.1         2       Chapter 2: < LINEAR REGRESSION > (6/0/12)         A/ Contents and teaching methods: (3)       G1.1         2.1 Linear regression       G1.1         2.2 Object function       G1.1         2.3 Optimization       G1.1         Teaching methods:       + Theoretical lectures         + Questions       G1.1         B/ Self-study contents: (6)       G1.1         + Exercises       G1.1         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)       G1.1         A/ Contents and teaching methods:(3)       G1.1         Contents:       2.4 Multivariable problems       G1.1         2.5 Multivariable features       G1.1         2.6 Optimal multivariable function       G1.1         Teaching methods:       + Theoretical lectures         + Questions       G1.1         B/ Self- study contents: (6)       + Standard equation		+ Questions	
+ Inductive methods		<i>B</i> / Self-study contents: (6)	
Chapter 2: < LINEAR REGRESSION > (6/0/12)         A/ Contents and teaching methods: (3)         Contents:         2.1 Linear regression         2.2 Object function         2.3 Optimization         Teaching methods:         + Theoretical lectures         + Questions         B/ Self-study contents: (6)         + Object function derivative         + Exercises         Contents:         2.4 Multivariable problems         2.5 Multivariable features         2.6 Optimal multivariable function         Teaching methods:         + Theoretical lectures         2.4 Multivariable features         2.5 Multivariable features         2.6 Optimal multivariable function         Teaching methods:         + Theoretical lectures         + Questions         B/ Self- study contents: (6)         + Standard equation			G1.1
A/ Contents and teaching methods: (3)       G1.1         Contents:       2.1 Linear regression         2.2 Object function       3.3 Optimization         Feaching methods:       4.1 Contents and teaching methods:         4.7 Eventical lectures       4.1 Contents and teaching methods:         5       B/ Self-study contents: (6)         4.7 Contents and teaching methods:       61.1         6.1       C1.1         7       Contents:         7       Contents         7			
Contents:2.1 Linear regression61.122.2 Object function92.3 Optimization10.1Teaching methods:+ Theoretical lectures10.1+ Questions10.1B/ Self-study contents: (6)+ Object function derivative+ Exercises10.1Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)A/ Contents and teaching methods: (3)10.1Contents:2.4 Multivariable problems2.5 Multivariable features2.6 Optimal multivariable functionTeaching methods:4.1 Contents:2.6 Optimal multivariable function11.1Teaching methods:11.1* Questions11.1B/ Self- study contents: (6)11.1+ Standard equation11.1			
2       2.1 Linear regression 2.2 Object function 2.3 Optimization       G1.1         2       Teaching methods: + Theoretical lectures + Questions       G1.1         B/Self-study contents: (6) + Object function derivative + Exercises       G1.1         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)       G1.1         A/ Contents and teaching methods:(3)       G1.1         Contents: 2.5 Multivariable problems 2.5 Multivariable features 2.6 Optimal multivariable function       G1.1         3       B/Self- study contents: (6) + Questions       G1.1			
22.2 Object function 2.3 OptimizationG1.12 <b>Teaching methods:</b> + Theoretical lectures + QuestionsG1.1 <b>B/ Self-study contents:</b> (6) + Object function derivative + ExercisesG1.1 <b>Chapter 2:</b> < LINEAR REGRESSION (cont.)> (6/0/12)G1.1 <b>A/ Contents and teaching methods</b> : (3) <b>Contents:</b> 2.5 Multivariable problems 2.5 Multivariable features 2.6 Optimal multivariable function <b>Teaching methods</b> : + Theoretical lectures + QuestionsG1.13 <b>B/ Self- study contents</b> : (6) + Standard equationG1.1			
2       2.3 Optimization         Teaching methods:       +         +       Theoretical lectures         +       Questions         B/ Self-study contents: (6)       G1.1         +       Object function derivative         +       Exercises         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)         A/ Contents and teaching methods:(3)         Contents:       2.4 Multivariable problems         2.5 Multivariable features       G1.1         2.6 Optimal multivariable function       G1.1         Teaching methods:       +         +       Theoretical lectures         +       Questions         B/ Self- study contents: (6)       G1.1         F Standard equation       G1.1			
2       Teaching methods: + Theoretical lectures + Questions       File         B/ Self-study contents: (6) + Object function derivative + Exercises       G1.1         G1.1       G1.1         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)       G1.1         A/ Contents and teaching methods:(3)       G1.1         Contents: 2.4 Multivariable problems 2.5 Multivariable features 2.6 Optimal multivariable function       G1.1         3       Teaching methods: + Theoretical lectures + Questions       G1.1         3       B/ Self- study contents: (6) + Standard equation       G1.1		2.2 Object function	G1.1
3       Freaching methods:         + Theoretical lectures         + Questions         B/Self-study contents: (6)         + Object function derivative         + Exercises         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)         A/ Contents and teaching methods:(3)         Contents:         2.4 Multivariable problems         2.5 Multivariable features         2.6 Optimal multivariable function         Teaching methods:         + Theoretical lectures         + Questions         B/Self- study contents: (6)         + Standard equation	2	2.3 Optimization	
+ Questions       -+ Questions         B/ Self-study contents: (6)	Z		
B/ Self-study contents: (6)       G1.1         + Object function derivative       G1.1         + Exercises       G1.1         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)         A/ Contents and teaching methods: (3)         Contents:       2.4 Multivariable problems         2.5 Multivariable features       G1.1         3       Teaching methods:         + Theoretical lectures       G1.1         + Questions       G1.1         B/ Self- study contents: (6)       G1.1		+ Theoretical lectures	
+ Object function derivative       G1.1         + Exercises       G1.1         Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)       A/ Contents and teaching methods:(3)         A/ Contents and teaching methods:(3)       G1.1         Contents:       2.4 Multivariable problems         2.5 Multivariable features       G1.1         3       2.6 Optimal multivariable function         Teaching methods:       + Theoretical lectures         + Questions       B/ Self- study contents: (6)         + Standard equation       G1.1		+ Questions	
<ul> <li>+ Object function derivative</li> <li>+ Exercises</li> <li>Chapter 2: &lt; LINEAR REGRESSION (cont.)&gt; (6/0/12)</li> <li>A/ Contents and teaching methods:(3)</li> <li>Contents:         <ul> <li>2.4 Multivariable problems</li> <li>2.5 Multivariable features</li> <li>2.6 Optimal multivariable function</li> </ul> </li> <li>3 Teaching methods:         <ul> <li>+ Theoretical lectures</li> <li>+ Questions</li> </ul> </li> <li>B/ Self- study contents: (6)</li> <li>+ Standard equation</li> </ul>		<i>B</i> / Self-study contents: (6)	
Chapter 2: < LINEAR REGRESSION (cont.)> (6/0/12)         A/ Contents and teaching methods:(3)       Contents:         2.4 Multivariable problems       2.5 Multivariable features         2.5 Multivariable features       G1.1         3       Teaching methods:         + Theoretical lectures       + Questions         B/ Self- study contents: (6)       G1.1		+ Object function derivative	G1.1
A/ Contents and teaching methods:(3)         Contents:         2.4 Multivariable problems         2.5 Multivariable features         2.6 Optimal multivariable function         Teaching methods:         + Theoretical lectures         + Questions         B/ Self- study contents: (6)         + Standard equation         G1.1		+ Exercises	
Contents:       2.4 Multivariable problems       61.1         2.5 Multivariable features       61.1         3       Teaching methods:       7         + Theoretical lectures       4         + Questions       60         B/ Self- study contents: (6)       61.1		Chapter 2: < LINEAR REGRESSION (cont.)>(6/0/12)	
<ul> <li>2.4 Multivariable problems</li> <li>2.5 Multivariable features</li> <li>2.6 Optimal multivariable function</li> <li>Teaching methods:</li> <li>+ Theoretical lectures</li> <li>+ Questions</li> </ul> B/ Self- study contents: (6) <ul> <li>+ Standard equation</li> <li>G1.1</li> </ul>		A/ Contents and teaching methods:(3)	
3     2.5 Multivariable features     G1.1       3     2.6 Optimal multivariable function     G1.1       3     Teaching methods:        + Theoretical lectures     +       + Questions        B/ Self- study contents: (6)     G1.1		Contents:	
<ul> <li>3</li> <li>2.6 Optimal multivariable function</li> <li>3</li> <li>Teaching methods:         <ul> <li>+ Theoretical lectures</li> <li>+ Questions</li> </ul> </li> <li>B/ Self- study contents: (6)</li> <li>+ Standard equation</li> <li>G1.1</li> </ul>		2.4 Multivariable problems	
3       Teaching methods:         +       Theoretical lectures         +       Questions         B/ Self- study contents: (6)         +       Standard equation         G1.1		2.5 Multivariable features	G1.1
<ul> <li>+ Theoretical lectures</li> <li>+ Questions</li> <li>B/ Self- study contents: (6)</li> <li>+ Standard equation</li> <li>G1.1</li> </ul>		2.6 Optimal multivariable function	
+ Questions       B/ Self- study contents: (6)       + Standard equation       G1.1	3	Teaching methods:	
B/ Self- study contents: (6)+ Standard equationG1.1		+ Theoretical lectures	
+ Standard equation G1.1		+ Questions	
+ Standard equation G1.1		<i>B</i> /Self- study contents: (6)	
			G1.1
		+ Optimal by standard equation	
Chapter 3: < CLASSIFICATION> (3/0/6)		Chapter 3: < CLASSIFICATION> (3/0/6)	
A/ Contents and teaching methods: (3)		A/ Contents and teaching methods: (3)	
4 Contents: G1.1	4		G1.1
3.1 Classification	-	3.1 Classification	
3.2 Object function for classified problems		3.2 Object function for classified problems	
		3.3 Optimal objet function for classified problems	

	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> /Self- study contents: (6)	G1.1
	+ Calculating derivation for target function	
	+ Exercises	
	Chapter 4: < OVERFITING > (3/0/6)	
	A/ Contents and teaching methods: (3)	
	Contents:	
	4.1 Overfitting problem	
	4.2 Identification overfitting problem.	G3.1
F	4.3 Handle overfitting problem	
5	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> / Self- study contents: (6)	
	+ Calculating gradient in a regilization	G3.1 - G3.2
	+ Exercises	
	Chapter 5: < NON-LINEAR SYSTEMS > (9/0/18)	
6	A/ Contents and teaching methods: (3)	
	Contents:	
	5.1 Neuron network	
	5.2 Object function	G1.2
	Teaching methods:	
	+ Questions and answers	
	+ Guide	
	<i>B</i> / Self- study contents: (6)	G1.2
	+ Reinforce the knowledge learned	01.2
7	Chapter 5: < NON-LINEAR SYSTEMS (cont.) > (9/0/18)	
	A/ Contents and teaching methods: (3)	
	Contents:	
	5.3 Forward propagation	
	5.4 Backward propagation	G1.2
	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> / Self- study contents: (6)	
	+ Reinforce the knowledge learned	G1.2
	+ Exercises	
8	Chapter 5: < NON-LINEAR SYSTEMS (cont.) > (9/0/18)	

	A/Contents and teaching methods: (3)	
	Contents:	
	5.5 Suport Vector Machine	
	5.6 Using support vector machine	G1.2
	5.6 Using support vector machine <b>Teaching methods</b> :	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> / Self- study contents: (6)	G1.2
	+ Exercises	G2.1
	Chapter 6: < MODEL SELECTION> (3/0/6)	
	A/ Contents and teaching methods: (3)	
	Contents:	
	6.1 Select model size	
	6.2 Select model parameters	
0	6.3 Dataset Evaluation	G3.2
9	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> /Self- study contents: (6)	
	+ Reinforce the knowledge learned	
	<i>Chapter 7: &lt; CLUSTERING &gt; (3/0/6)</i>	
	A/ Contents and teaching methods: (3)	
	Contents:	
10	7.1 Unsupervised learning	
	7.2 Clustering problems	
	7.3 K-means algorithm	G1.3
	7.4 Graph method	
	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> /Self- study contents: (6)	
	+ Spectral clustering method	G2.1
11	PROJECT REPORT	
	A/ Contents and teaching methods: (3)	
	Contents:	
	1 Project report	G2.1
	Teaching methods:	G2.2
	+ Presentation	G3.1
	+ Evaluation	

	<i>B</i> / Self- study contents: (6)	G2.1
	+ Reinforce the knowledge learned	G2.2 G3.2
	>(6/0/12)	
	A/ Contents and teaching methods: (3)	
	Contents:	
	8.1 Dimensonal reduction	
	8.2 Princible Component Analysis (PCA)	G1.4
12	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> /Self- study contents: (6)	
	+ LDA method	G1.4
	+ Exercises	
	Chapter 8: < DIMENSIONAL REDUCTION OF DATA (cont.) >	
	(6/0/12)	
	A/ Contents and teaching methods: (3)	
	Contents:	
	8.3 LLE method	
	8.4 Iso-Map method	G1.4
13	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> / Self- study contents: (6)	
	+ Progam the LLE- Iso Map methods	G1.4
	+ Exercises	
	Chapter 9: < RECOMMENDATION SYSTEMS > (3/0/6)	
	A/ Contents and teaching methods: (3)	
	Contents:	
	9.1 Introduced about recommendation systems	
	9.2 Hidden models	G1.4
14	9.3 Program recommendation systems	01.4
14	Teaching methods:	
	+ Theoretical lectures	
	+ Questions	
	<i>B</i> / Self- study contents: (6)	
	+ Reinforce the knowledge learned	G1.4
	+ Exercises	
	PROGRAMMING EXERCISES REPORT	
15	PROGRAMMING EXERCISES REPORT         A/ Contents and teaching methods: (3)	G2.1 G2.2

1 Recommendation systems	G3.2
2 Hidden models	
3 Recommendation systems programing	
Teaching methods:	
Report – Assess	
<i>B</i> / Self- study contents: (6)	
+ Reinforce the knowledge learned	G3.1
+ Group Discussion	G3.2

#### **12. Learning ethics:**

- Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get zero point

## 13. First approved date:

## 14. Approval level:

Dean	Department	Instructor

## **15. Syllabus updated process**

1 <sup>st</sup> time: Updated content dated	Instructors
2 <sup>st</sup> time: Updated content dated	Head of department