Menoufia University	*Second Year*
Faculty of Engineering	*Prod. Metrology*
Prod. Eng. & Mech.	*Three Hrs.*
Design Dept.	*7 / 6 / 2015*

This Exam measures ILOS No.:(a1 -1,a12-1,a12-2,a19-1,b8-1, b17-1, c1-1,c9-1,c14-1).

Answer all the following questions: (Marks of exam=100).

Question (1) *(10 Marks)*

a) What are the fields of sciences that are required for metrology?

b) Differentiate between accuracy and Uncertainty with example.

c) What are the important elements of measurements?

d) What is the need of inspection?

Question (2) *(20 Marks)*

a) Differentiate between sensitivity and range with suitable example.

b) Explain how you evaluate the different errors of outside and inside caliper.

c) Draw the following reading: 15 .1mm, 16.01mm, 17.04mm and 18.58mm.

d) Draw front view of one from the following Micrometres: -V- anvil Micrometre, Digital inside Micrometre and Micrometre Bore.

Question (3) *(20 Marks)*

a) Write about the causes of workpiece variation.

b) Draw and explain the basics of different possible combinations of fits.

c) Calculate the different tolerances of the following dimensions: 35 H8/g6 and 35 H9/d9. (Using tolerance tables-Below).

d) Describe and draw the relations when assembled two mating parts.

Question (4) *(20 Marks)*

a) Classify the comparator according to the principles used for obtaining magnification. And Draw one type.

b) List and draw the various parts of an optical comparator.

c) What are the major types of on electrical comparator?- Draw one type.

d) What are the various fundamental requirements which every comparator must fulfil?

Question (5) *(20 Marks)*

a) Draw the flow chart of design for manufacturing.

See Page (2)

b) What are the advantages and benefits of using fixed limit gauges?

c) Which operation the following gauges are used: i) Plain gauges, ii) Standard gauges, iii) Limit gauges ,d) Workshop Gauges, v) Inspection Gauges, vi) Reference or master gauges.

d) Taylor's Principle is the key to design of limit gauges, how.

Question (6) *(10 Marks)*

a) Explain the following types of errors. -Systematic errors and Random errors.

b) Classify the Absolute error and what is Relative error?

c) What are the Major Requirements for Slip Gauges?

d) Draw the diagram of the instrument which used for testing the flatness of slip gauges.

(Exam Marks):

Question No.	1	2	3	4	5	6
Marks	10	20	20	20	20	10

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This Exam Measure The following ILOs										
Question Number	Q1-a,b	Q3-b,d	Q4- b, d	Q5-d	Q6-a,d	Q2-b,c,d	Q1-c,d	Q2-a	Q3-a, c	Q4-a,c	Q5-a,b,c
Skills	a1-1	a12-1	a12-2	a19-1	a19-1	a12-2	b8-1	b17-1	c14-1	c1-1	c9-1
	Knowledge &Understanding						Intellectual and Professional skills				

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	Tolerances of holes					Tolerances of shafts				
Nominal sizes	H7	H8	H9	H10	H11	d9	e8	f7	g6	h6
Over 18 Upto 30	+21 0	+33 0	+ 52 0	+ 84 0	+130 0	- 65 -117	- 40 - 73	- 20 - 41	- 7 -20	0 -13
Over 30 Upto 50	+25 0	+39 0	+ 62 0	+100 0	+160 0	-80 -142	- 50 - 89	- 25 - 50	- 9 -25	0 -16
Over 50 Upto 80	+30 0	+46 0	+ 76 0	+120 0	+190 0	-100 -174	- 60 -105	- 30 - 60	-10 -29	0 -19