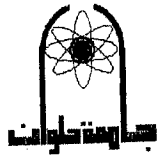
 Faculty of Engineering	Dept /division: Mechanical Engineering/ Industrial Academic level: 3 <sup>rd</sup> year Course title/code: Engineering Measurement Systems (MEC 6313) Instructor: Prof. Dr. Mohamed Rady, Asst. Prof. Mohamed Abdallah Bhlol, Asst. Prof. Mohamed Abdalla Attia Final-term Exam, Jan 2016 Total marks: 90 marks Time allowed: 3 hrs	 جامعة القاهرة
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الإمتحان في صفتين

Answer the following questions

**Question (1) [25 Marks]**

- a) Explain using sketches the following terms: Noise and interference, accuracy and precision, zero drift and sensitivity drift. [5 Marks]
- b) An opposing environmental input is a method to cancel the effect of interfering inputs. Discuss this method and give an example with a clear sketch. [5 Marks]
- c) Determine the overall uncertainty ( $U_P$ ) in the result of the function P; which is given by:  $P = a^3 b/c^2$ . If  $a = 8$  mm,  $c = 5$  mm and the values of b in 10 measurements is as shown in Table below. The possible error in each measurement of a and c is  $\pm 1\%$ . [15 Marks]

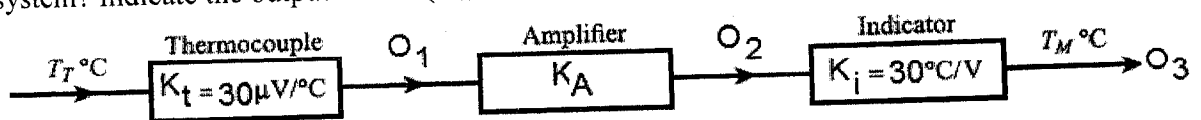
Measurement	1	2	3	4	5	6	7	8	9	10
b	12.05	12.12	12.51	12.35	11.95	12.03	12.58	12.84	12.34	12.01

**Question (2) [35 Marks]**

- a) A displacement sensor has an input range of 0 to 3 cm and a standard supply voltage  $V_s = 0.5$  volt. Using the calibration results given in the table below estimate: (i) The range, span, and ideal straight line equation, (ii) The maximum nonlinearity as a percentage of f.s.d, (iii) Considering the environmental effects due to supply voltage  $V_s$ , determine the values of  $K_m$ ,  $K_i$ , a and K associated with the generalized model equation:  $O = (K + K_m I_m) I + a + K_i I_i$ . [15 Marks]

X (cm)	0	0.5	1	1.5	2	2.5	3
Output voltage (mv) ( $V_s = 0.5$ )	0	16.5	32	44	51.5	55.5	58
Output voltage (mv) ( $V_s = 0.6$ )	0	21	41.5	56	65	70.5	74

- b) For the measurement system shown below: what will be the value of  $K_A$  to be a perfect system? Indicate the output values ( $O_1, O_2, O_3$ ) and their dimensions. [10 Marks]



- c) A data acquisition system with an analog to digital converter is required to measure voltage in the range of 0-10 V. How many bits are required to achieve a resolution of 0.001 % of full scale voltage? [10 Marks]

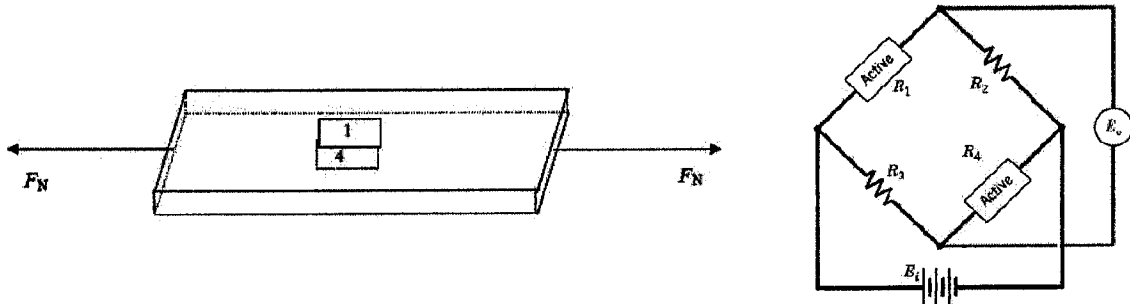
**Question (3) [30 Marks]**

- (a) Explain using sketches (i) the design features and (ii) the important precautions for radiation pyrometer thermometer. [6 Marks]
- (b) Describe the principle of operation of strain gauge pressure transducers. [4 Marks]

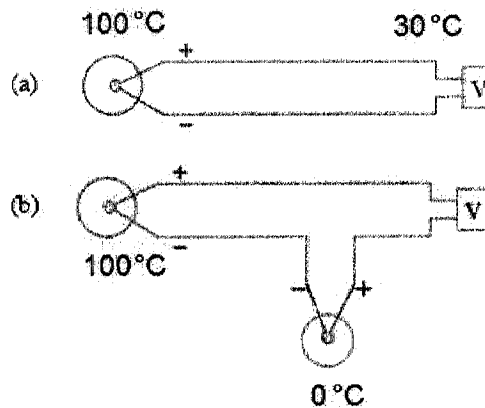
(C) A steel member with Poisson ratio  $\nu_p = 0.3$  is subject to simple axial tension as shown in Figure below. Strain gauges are mounted on top center, and bottom center. The strain gauge Gauge Factor  $GF = 2$ , all Resistors of Wheatstone bridge  $R = 120 \Omega$ , the change in voltage output is of Wheatstone bridge  $\delta E_o = 10 \mu V$ , and the input voltage  $E_i = 10 V$ .

Determine: [10 Marks]

- Bridge constant for gauge locations 1 and 4.
- Is the system temperature compensated?
- The axial and transverse strain.




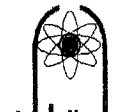
(d) A K type thermocouple is used as shown in Fig. (a) below without a reference junction. The terminals of the voltmeter are at room temperature of  $30^\circ C$  while the measuring junction is at  $100^\circ C$ . What is the voltmeter reading? What would have been the reading had it been connected as shown in Fig. (b) with reference junction at  $0^\circ C$ . [10 Marks]



ITS-90 Table for type K thermocouple

$^\circ C$	0	1	2	3	4	5	6	7	8	9	10
	Thermoelectric Voltage in mV										
0	0.000	0.039	0.079	0.119	0.158	0.198	0.238	0.277	0.317	0.357	0.397
10	0.397	0.437	0.477	0.517	0.557	0.597	0.637	0.677	0.718	0.758	0.798
20	0.798	0.838	0.879	0.919	0.960	1.000	1.041	1.081	1.122	1.163	1.203
30	1.203	1.244	1.285	1.326	1.366	1.407	1.448	1.489	1.530	1.571	1.612
40	1.612	1.653	1.694	1.735	1.776	1.817	1.858	1.899	1.941	1.982	2.023
50	2.023	2.064	2.106	2.147	2.188	2.230	2.271	2.312	2.354	2.395	2.436
60	2.436	2.478	2.519	2.561	2.602	2.644	2.685	2.727	2.768	2.810	2.851
70	2.851	2.893	2.934	2.976	3.017	3.059	3.100	3.142	3.184	3.225	3.267
80	3.267	3.308	3.350	3.391	3.433	3.474	3.516	3.557	3.599	3.640	3.682
90	3.682	3.723	3.765	3.806	3.848	3.889	3.931	3.972	4.013	4.055	4.096
100	4.096	4.138	4.179	4.220	4.262	4.303	4.344	4.385	4.427	4.468	4.509
110	4.509	4.550	4.591	4.633	4.674	4.715	4.756	4.797	4.838	4.879	4.920
120	4.920	4.961	5.002	5.043	5.084	5.124	5.165	5.206	5.247	5.288	5.328
130	5.328	5.369	5.410	5.450	5.491	5.532	5.572	5.613	5.653	5.694	5.735
140	5.735	5.775	5.815	5.856	5.896	5.937	5.977	6.017	6.058	6.098	6.138

Good Luck

 كلية الهندسة بحلوان	Dept/Division : Mechanical Engineering Dept / Industrial Academic level: 3 <sup>rd</sup> year Semester: 1 <sup>st</sup> semester (2015-2016) Course code & title: Project Planning and Control (MEC6311) Instructor: Dr. Haitham Abbas Final Exam Total mark: 100 Time allowed: 3 Hours	 جامعة حلوان
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**Answer all of the following questions**

**Question 1 (35 Marks)**

- a. Explain the term "Stakeholders Analysis". [5 Marks]
- b. The information of a project necessary for the PERT analysis is given in the table below.

Activity	Predecessor(s)	Times (weeks)			Labor Required/week
		Optimistic	Most Likely	Pessimistic	
A	-	1	5	9	10
B	A	2	4	6	12
C	A	5	6	7	14
D	A	1	3	11	13
E	B,C	8	10	12	5
F	D	6	8	10	8
G	D	7	8	9	6
H	E	3	3	9	9
I	E	5	7	9	10
J	F,G	2	4	6	12
K	H,I	3	3	3	10
L	J	1	6	23	4
M	G	2	6	16	5
N	K,L,M	3	3	3	7

- a. Construct the project network and determine the project's mean completion time and the standard deviation of the project's completion time. [10 Marks]
- b. Draw the Gantt chart of the project and graphically define the weekly workers resource loading. And recommend actions to smooth the work loads. [20 Marks]

**Question 2 (25 Marks)**

- a. Differentiate between the direct and the indirect project expenses. Give examples of each category. [5 Marks]
- b. The data of a project including the main activities, the predecessor activities, and the normal and crash times and costs are summarized in the following table [see the next page]. Establish the optimum plan [activity and cost] for decreasing the total normal time of the project by 5 days.

Activity	Predecessor(s)	TIMES (Days)		COSTS (LE)	
		Normal	Crash	Normal	Crash
A	-	12	6	1500	2100
B	A	6	4	500	950
C	A	7	6	200	250
D	B,C	5	5	1200	1200
E	D	9	6	800	1400
F	D	9	7	700	1050
G	D,F	8	7	950	1100
H	C,G	4	3	1000	1300
I	H	6	4	830	990
J	I	11	8	1400	1940

[20 Marks]

**Question 3 (20 Marks)**

The different NCF values of 3 projects are shown in the Table below.

Project	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Project 1	-\$100,000	40,000	30,000	30,000	20,000	25,000
Project 2	-\$150,000	50,000	40,000	50,000	60,000	55,000
Project 3	-\$120,000	40,000	35,000	30,000	40,000	55,000

For an annual interest rate of 10%, select the best project using:


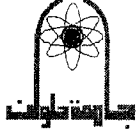
- I. Payback period approach, and [10 Marks]
- II. Internal rate of return approach. Using the MARR as 18% [10 Marks]

**Question 4 (20 Marks)**

- a. What are the basic characteristics of the resource leveling process? [5 Marks]
- b. The cost behavior of the project in its first 6 months is exhibited in the table below. The total budget of the project is \$2,000,000 and the estimated original time of the project is 10 months.

Cost data	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Budgeted cost (\$)	160,000	160,000	160,000	160,000	160,000	160,000
Earned value (\$)	150,000	150,000	130,000	420,000	300,000	280,000
Actual cost (\$)	200,000	150,000	250,000	220,000	300,000	400,000

- I. Use the EVM to evaluate the project's progress performance over the six months. [12 Marks]
- II. Construct the S-Curve. [3 Marks]

 كلية الهندسة بحلوان	<b>Dept/Division : MECHANICAL ENG. Industrial Eng. Division</b> <b>Academic level: Third Year</b> <b>Semester: First 2015/16</b> <b>Course code &amp; title: MEC 6312 -- Work Study and Productivity Analysis</b> <b>Instructor: Dr. Ahmed Abd Elmoaty</b> <b>Total mark: 90 mark</b> <b>Time allowed: 3 hrs</b>	
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Answer all questions

**Question# 1: (MARK 10 )**

- 1- Explain: the relation between total profit of a firm and total productivity. And determine the breakeven point
- 2- Proof that:

Total productivity of a firm as a function of partial productivities.

$$TPF = \sum_{i=1}^N W_{ij}' \times PP_{ij}$$

**Question# 2: (MARK 25 )**

The data given the detailed Input and Output for two products to a firm that manufactures two products in the last quarter of 2015.

	Items	Description	Prod. #1	Prod.#2	
Outputs	1- Finished units	Quantity produced (Unit)	2500	2000	
		- Price / unit \$	6	5	
	2- Produced units	Quantity produced (unit)	200	1000	
		-Price / unit \$	1.10	1.0	
		-Percent completion%	46	70	
Inputs	1- Human input	- Total hours worked	390	550	
		- average wage rate / hour (\$ / hr)	7.5	6.5	
	2- Material input	- Tons of raw material	12	10	
		- Price / ton (\$/ton)	1.3	1.20	
		- Purchased parts	190	120	
		- Price / part (\$/ Part)	2.0	1.50	
	3- Capital Input	- Total money for fixed cost	2000	6000	
		- Total money for working cost	4000	9000	
	4- Energy input	a- Gallons of oil	Price /gal	30	25
				1.15	1.00
		b- Tons of coal	Price / ton	5	6
				5.50	5.50
		c- k w h of electricity	price / k w h	1500	1000
			0.55	0.50	
	5- Other expense input	a- Consulting fee, Marketing expense	4550	4650	

Determine:

- a- Partial productivity index all products with respect to all input factors. If consider product 2 base and others are current.
- b- By using the last data Proof that The sum of partial productivities is not equal to total productivity.

$$\sum_j PP_{ij} \neq TP_i$$

- d- Total productivity of a firm as a function of total productivities of individual products.

**Question# 3: (MARK 10 )**

- 1- Define:
  - a- Four Objectives of work measurement
  - b- Three types of time study equipment.
  - c- Three types of recording techniques which are used in recording the facts through the method study.
- 2- Explain : The basic procedure of the work measurement.

**Question# 4: (MARK 10)**

Define:

- A. Marit rating
- B. Four Objectives of marit rating
- C. Wage incentive plans ( 5 only rating ) and Explain one of them.
- D. Methods and technique of job evaluation.

**Question# 5: (MARK 15)**

Draw a man machine chart showing one man (the operator) operating three machines. The cycle consists of as shown in table: Each machine completes the machining operation and stops automatically. The operator starting the machines in the morning with all machines empty, and continues until all Machines completes three cycles.

time (min)	M/c		
	1	2	3
Load time	0.25	0.75	0.5
Machining time	1.25	1.5	1.25
Machine stops auto. Time at the end of cut	0.5	0.25	0.25

Determine:

- a- The Idle and working time, also,
- b- utilization ratio for man and M/c.

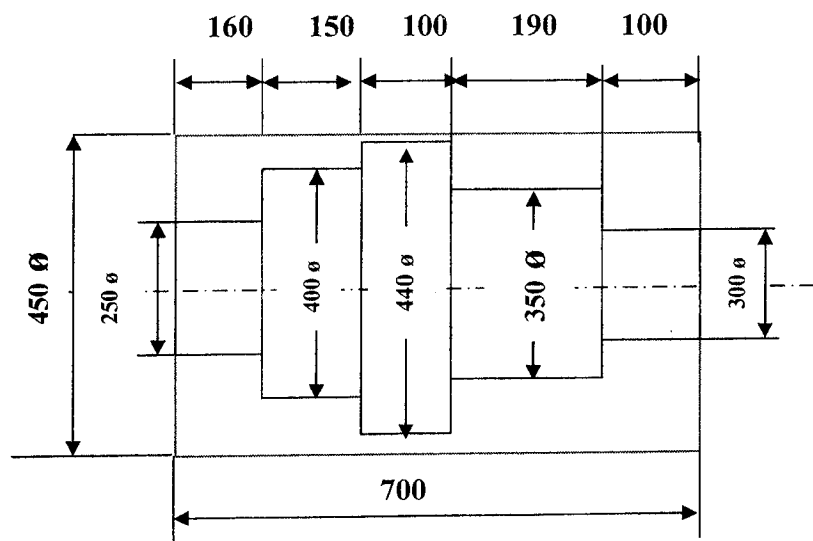
**Question# 6: (MARK 20)**


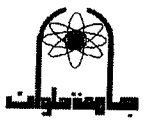
As shown in figure (1), a manufacturing cell contains 2 automatic turning machines, is assigned to manufacture all the heavy cylindrical parts. One skilled operator is responsible for the total amount of work in this cell. Assume the operation to completes the product and determine the standard time for each element and standard time for operation.

Part Name	Part Code			Machining		
Heavy Shaft	0314	Machine No.	Standard Speeds (rpm)	Cutting Velocity (m/min)	Observed Rating	Allowance
Stock Size	700×Ø 450	2	45, 71, 90, 125, 180, 250, 355, 500	Rough (50), Finish (100)	<b>assume</b>	Sum not increase 100%
Operation #	Description		Feed	Depth of cut	R	A %
	Rough turning		0.8 mm/rev	5 mm/cut	100	
	Fine turning		0.4 mm/rev	2 mm/cut	105	

$$T_m = \frac{L'}{F \cdot n} \quad i \quad L' = L + (10:20) \quad BT = T_m \times R \quad ST = BT \times \frac{100}{100 - A}$$

$$V = \frac{\pi D_m n}{1000} \text{ m/min} \quad D_m = \frac{D_o + D_i}{2} \quad i \text{ (No. of cuts)} = \frac{D_o - D_i}{2 a}$$



 Faculty of Engineering	Dept: Mech. Eng. (IE Branch) Courses code: Third Year (Industrial) Title: Power System Analysis, Jan. 2016 Instruction: Prof. Dr. Laila Ahmed Talat Total mark: 70 mark      Time allowed: 3 hrs	 جامعة القاهرة
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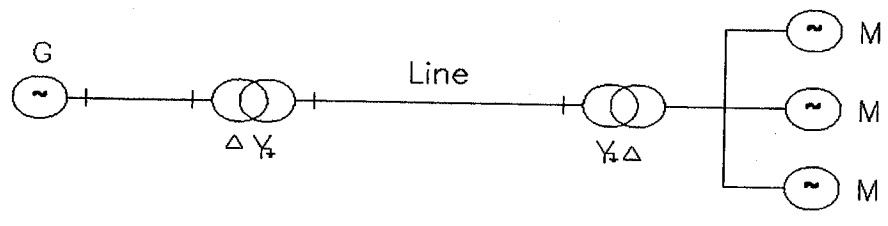
Answer the following questions

**Q1**

- (a) What are the possible factors to locate the steam power plants?
- (b) Sketch the vector representation of complex power for capacitive load and write the power absorbed by this load.
- (c) For  $Z = 3 + j 4$  ohm and the current  $i = 6 + j 8$  A , calculate :
  - (i) The real power P and reactive power Q.
  - (ii) The instantaneous power.

**Q2**

- (a) Draw the per – unit impedance diagram for single – line diagram of a power system as shown in Figure (1).



Fig(1)

(b) Loads on a feeder during 24 hours of a day are given below:

Time	Load(KW)	Time	Load(KW)	Time	Load(KW)
12 am	400	8 am	1000	16 pm	1400
1 am	380	9 am	1200	17 pm	1300
2 am	350	10 am	1350	18 pm	1500
3 am	300	11 am	1200	19 pm	2200
4 am	350	12 pm	1000	20 pm	2000
5 am	500	13 pm	970	21 pm	1950
6 am	700	14 pm	1250	22 pm	1000
7 am	750	15 pm	1300	23 pm	800

- (1) Calculate the maximum demand, average demand and load factor of the feeder.
- (2) If the feeder has the average loss of 16 KW and annual loss factor of 0.12, find the following:
- The peak power loss of the feeder at peak load
  - The total annual loss of the feeder
  - The demand factor of the feeder if the connected demand is 2600 KW.

### Q3

- (a) Write the factors need to be considered of deciding the transmission systems.

(b) A three – phase, overhead short transmission line. The receiving end line voltage is 30 KV and the phase impedance is  $6 + j 16$  Ohm. If the load at the receiving end is 3000 KW and has a power factor of 0.8 lagging, 50 Hz. Calculate :

- The sending end voltage and power factor .
- The voltage regulation and the efficiency of the transmission line.
- Draw the phasor diagram showing the voltage – current relationship.

### Q4

- (a) Sketch 3 – types of the distributors and compare between them.

(b) A distributor AB is fed from both the ends, as shown in Figure (2). The loop resistance of the distributor is 0.5 ohm /Km. If the distributor is fed at A with 250 volt and B with 255 volt, calculate:

- The current in the various sections of the distributor.
- The minimum voltage and the point at which is occurs.
- The maximum voltage regulation and the total efficiency of the distributor.

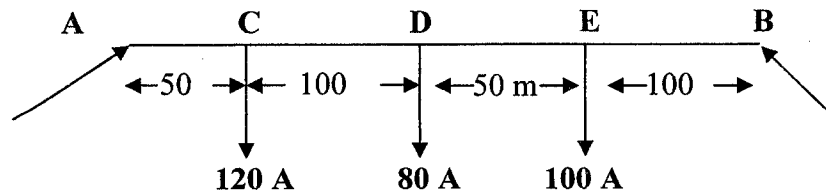


Fig. (2)

**Good Luck**