

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: FEE 1113
COURSE	: BASIC ENGINEERING I
SEMESTER/SESSION	: 1-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **5** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

- a) Describe the difference between Engineering and Engineering Technology in testing and evaluation. (2 marks)
- b) Identify the following either Engineering Technology or Engineering
- (i) Research on safe nuclear power. (1 mark)
 - (ii) Plant operation and production. (1 mark)
 - (iii) Technical analysis on costing. (1 mark)
 - (iv) Development of new products. (1 mark)
- c) Differentiate TWO (2) typical duties of technician and technologist. (4 marks)
- d) (i) Using dimensional equations, convert 38.1 ft/s to miles/h. (3 marks)
- (ii) Using the table of conversion factors, convert 921 kg/m³ to lb/ft³ (3 marks)
- (iii) Using the table of conversion factors, convert 5.37 x 10³ kJ/min to hp. (4 marks)

QUESTION 2

- a) Describe the properties of Linear Low density polyethylene (LLDPE). (6 marks)
- b) Explain disadvantages of High Density Polyethylene (HDPE). (4 marks)
- c) The density of ethanol is 0.802 g/mL and a sample has a mass of 14.5 g. Calculate the volume of the sample. Give answer in 4 significant figures. (3 marks)
- d) If a man weighs 79 kg on Earth, calculate his weight on moon at the free-fall acceleration is 9.81 m/s^2 . Give answer in 3 significant figures. (3 marks)
- e) A compact car with a mass of 1,000 kg is accelerating due north at 5 m/s^2 . Calculate the force produced by this acceleration? Give answer in 5 significant figures. (4 marks)

QUESTION 3

a) Differentiate **four (4)** comparison of series and parallel circuit. (8 marks)

b) Determine the voltage, V across each resistor, R_1 , R_2 , R_3 and R_4 in Figure 1 by using voltage divider law.

(12 marks)

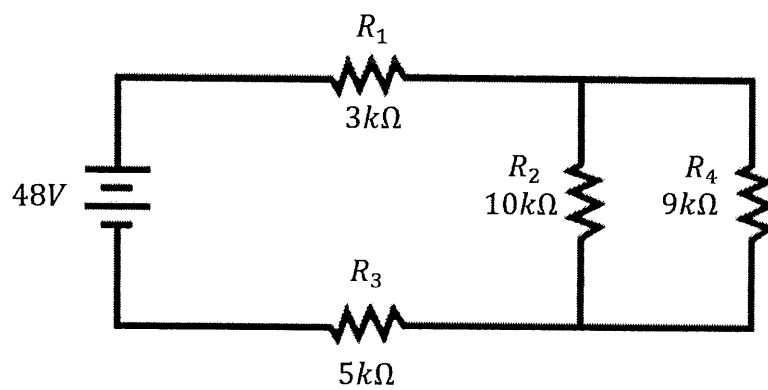


Figure 1

QUESTION 4

a) Figure 2 shows a resistor with four bands. The color code for each band is given in Table 1. Determine:

1. Determine:

- i. The resistance value. (3 marks)
- ii. The percent of tolerance. (1 mark)
- iii. The maximum value the resistor can tolerate. (2 marks)
- iv. The minimum value the resistor can tolerate. (2 marks)

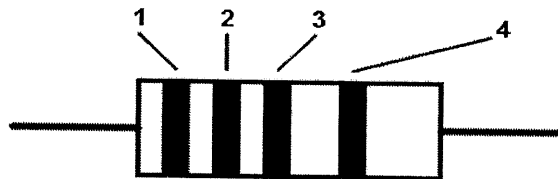


Figure 2

Table 1

Band	Color
1	Green
2	Blue
3	Violet
4	Silver

- b) Describe the basic construction of a capacitor. (5 marks)
- c) Determine the total capacitance, C_T of the circuit in Figure 3. Show all calculation. (7 marks)

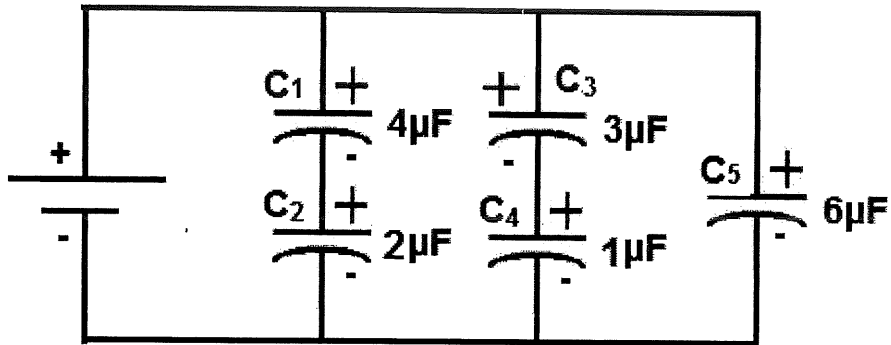


Figure 3

BASIC ENGINEERING I (FEE 1113)

QUESTION 5

- a) Discover the differences between quality of design and quality of conformance. (4 marks)
- b) Briefly predict how a company can achieve lower production costs and increase productivity by improving the quality of its products or services. (3 marks)
- c) Choose one quality tool and describe how it could be used for process improvement. (3 marks)
- d) Prepare a check sheet and then a Pareto diagram for the following car repair shop data in Table 2: (10 marks)

Table 2

Ticket No.	Work	Ticket No.	Work	Ticket No.	Work
1	Tires	11	Brakes	21	Lube & oil
2	Lube & oil	12	Lube & oil	22	Brakes
3	Tires	13	Battery	23	Transmission
4	Battery	14	Lube & oil	24	Brakes
5	Lube & oil	15	Lube & oil	25	Lube & oil
6	Lube & oil	16	Tires	26	Battery
7	Lube & oil	17	Lube & oil	27	Lube & oil
8	Brakes	18	Brakes	28	Battery
9	Lube & oil	19	Tires	29	Brakes
10	Tires	20	Brakes	30	Tires

----- End of questions -----

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QUESTION 1

- a) Identify if the dimensions in each of the following equations are consistent.

i. $v^2 = at$ (2 marks)

ii. $x = vt + \frac{at^2}{2}$ (2 marks)

iii. $max + \frac{mv^2}{2} = Fx^2$ (2 marks)

iv. $v^2 = 2ax + \frac{x}{t}$ (2 marks)

v. $v^2 = \frac{Fx}{m}$ (2 marks)

- b) A piece of lead of mass 11.97 g has a volume of 1.05 cm³. Calculate the density of lead in SI units. (5 marks)

- c) The volume of the sphere is given by the equation $V = \frac{4}{3}\pi r^3$ where V is the volume and r is the radius of the sphere. If the radius of the sphere is increased by a factor of 3, show the change in the volume of the sphere. (5 marks)

QUESTION 2

- a) Compare and contrast the properties of thermoplastics and thermosetting plastics. (6 marks)
- b) Discuss the basic properties of the polymer. (6 marks)
- c) You are given two unidentified plastic samples labeled A and B. Using your knowledge of plastic identification tests, apply two tests you would perform to identify the type of plastic for each sample. (8 marks)

QUESTION 3

- a) Differentiate **four (4)** comparison of series and parallel circuit. (8 marks)
- b) Determine the voltage, V across each resistor, R_1 , R_2 , R_3 and R_4 in Figure 1 by using voltage divider law. (12 marks)

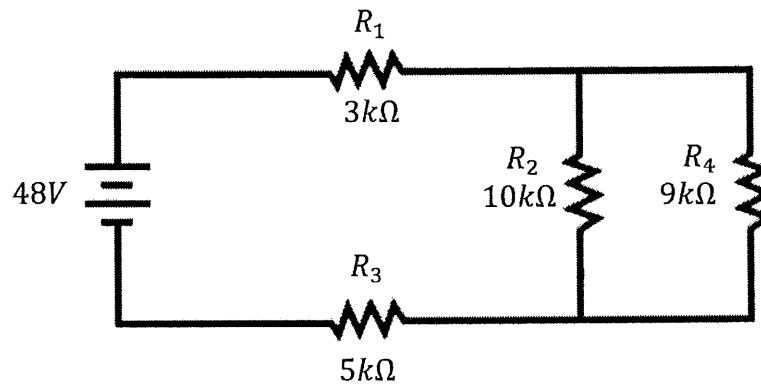


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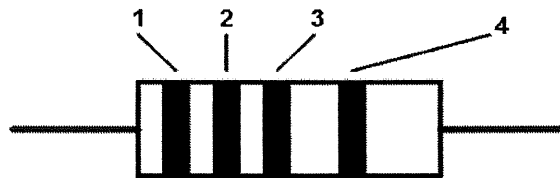


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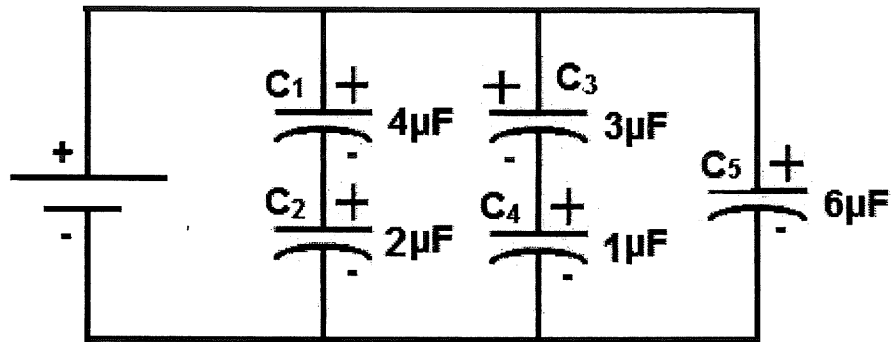


Figure 3

QUESTION 5

- a) Quality is defined as the ratio of performance (P) to expectation (E). Discover the meaning of quality for the following cases:
- i. Case 1: If $P > E$ (1 mark)
 - ii. Case 2: If $P = E$ (1 mark)
 - iii. Case 3: If $P < E$ (1 mark)

- b) Predict three (3) principles of Total Quality Management (TQM) that may be implicated based on the following scenario:

*“XYZ Manufacturing is a mid-sized corporation specializing in the manufacture of automotive components. The company has struggled to maintain high quality standards over the past few years, resulting in **consumer complaints** and a **decline in market share**. To address these issues, the **management team** has decided to implement Total Quality Management (TQM) principles to transform their operations and regain their competitive edge.”*

(3 marks)

- c) Sketch a flowchart for the process of getting out of bed in the morning using appropriate symbol and the points listed below:

- *Start*
- *Alarm rings*
- *Delay*
- *Ready to get up?*
- *Hit snooze button*
- *Climbed out of bed*
- *Finish*

(4 marks)

- d) Apply 3M (Man, Machine, Material) and 1E to illustrate the Ishikawa Diagram for "Poor Quality Product".

(5 marks)

- e) Table 2 depicts five weight samples of a given company's products.

Table 2: Data for Product's Weight

Sample	1	2	3	4	5	Total	
Mean (\bar{X})	383	508	505	582	557	2585	$\bar{\bar{X}} = ?$
Range (R)	95	128	100	91	68	482	$\bar{R} = ?$

If value $A_2 = 0.729$, use the appropriate formula to compute:

- i. $\bar{\bar{X}}$ and \bar{R} (1 marks)
- ii. Upper Control Limits (UCL_x) (2 marks)
- iii. Lower Control Limits (LCL_x) (2 marks)

----- End of questions -----