



PAST PAPERS

Faculty	Department / Section/Division
Not Applicable	Learning Resource Centre

Past Papers

Faculty of Engineering and technology

Department of mechanical engineering

Document Control & Approving Authority

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CINEC Campus

Faculty of Engineering & Technology

Department of Mechanical Engineering

First Year Semester 2 First Sit Final Examination 2024

Module Code	:	ME 1324
Module Title	:	Workshop Practice
Date/Time	:	16 th July 2024
Examiners	:	Virantha E.A.I
Time Allowed	:	3 hrs

INSTRUCTIONS TO CANDIDATES

- This is a **closed book** examination.
- This paper consists of four questions.
- Answer All questions.
- Write clearly legibly with a blue or black pen.
- Use answer booklet and additional paper provided by examination department.

MATERIALS REQUIRED

- CINEC answering Booklet; Extra answering paper and graph papers if required.
- You may use a scientific calculator. This must not be programmable. This may be examined during the examination.

Q1	(a) i. Explain orthogonal cutting operation and oblique cutting operation with the aid of sketches. 5 marks ii. Explain the generation of build-up edge in metal cutting and give suggestions to avoid generation of build-up edge. 6 marks (b) In an orthogonal metal cutting process following data were obtained. Rake angle used = 10° Friction coefficient in between tool face and chip = 0.6 Depth of cut = 1.5 mm Cutting speed = 150 m/min Width of cut = 2mm Work material shear strength = 400MPa Determine the following: i. Shear plane angle. ii. Chip thickness. iii. Shear force. iv. Percentage of energy consumed to overcome the friction at tool chip interface. v. Material removal rate. vi. Specific power of material removal. 14 marks
Q2	(a) Sketch the conventional centre lathe machine and name the six main components. 5 marks (b) What are the taper turning methods available with the conventional lathe machine. 6 marks (c) Determine suitable gears for cutting the following screws on a lathe lead-screw of $\frac{1}{4}$ inch pitch (4 thread/inch). (Assume the lathe machine is equipped with a set of gears ranging from 20T to 120T in steps of 5 and 127T gear wheel) i. 3 mm pitch ii. 1.75mm pitch iii. 0.8 mm pitch 14 marks

Q3	(a) What are the essential properties for the cutting tool materials. (b) Explain how the temperature is affected to the tool wear. (c) In a production turning operation, the workpart is 125 mm in diameter and 300 mm long. A feed of 0.225 mm/rev is used in the operation. If cutting speed = 3.0 m/s, the tool must be changed every five workparts; but if cutting speed = 2.0 m/s, the tool can be used to produce 25 pieces between tool changes. Determine the Taylor tool life equation for this job.	5 marks 6 marks 14 marks
Q4	(a) List the factors which influence the choice of proper casting method. (b) With the aide of sketches explain the operation of the induction furnace. (c) An aluminium cube of 12 cm side has to be cast along a cylindrical riser of height equal to its diameter. The riser is not insulated on any surface. If the volume shrinkage of aluminium during solidification is 6%. Calculate the followings. - Shrinkage volume of cube on solidification. - Minimum size of the riser so that it can provide the shrinkage volume.	5 marks 6 marks 14 marks



FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

BSC HONS (ENG) IN MECHANICAL ENGINEERING / MECHATRONIC ENGINEERING

BATCH 04 - SEMESTER 08

RESIT EXAMINATION

SEPTEMBER 2025

Module Code	:	ME4324
Module Title	:	Production Engineering, Planning & Control
Date	:	06 th September 2025
Examiners	:	Dr. GIP Perera / Mr. MGJP Fernando
Time Allowed	:	3 Hours (1330hrs – 1630hrs)

Instructions to Candidates:

- This is a **closed book** examination. No reference materials are allowed.
- This paper consists of **FIVE (05)** questions. Answer **ALL** questions.
- Use only the provided answer booklet, additional sheets, and the sheet which contains **Table 3.1** for your answers.
- Write clearly and legibly using a blue or black pen.
- Write your student number on **ALL** sheets.
- ***Start each question on a new page in the answer booklet. Clearly indicate the question number at the top of the page.***
- If parts of the same question are written discontinuously in different sheets, ensure that each part is appropriately labelled with its corresponding question number.
- Where appropriate, include clear diagrams or sketches. These can aid in calculations and help convey your answers effectively.
- If you are unsure about the wording of a question consult the Supervisor or Invigilator, or make reasonable assumptions. Clearly state such assumptions in your answer script.
- Marks will be deducted for missing or incorrect measuring units, and failure to adhere to the above instructions.
- You may use a scientific calculator but it must not be programmable.

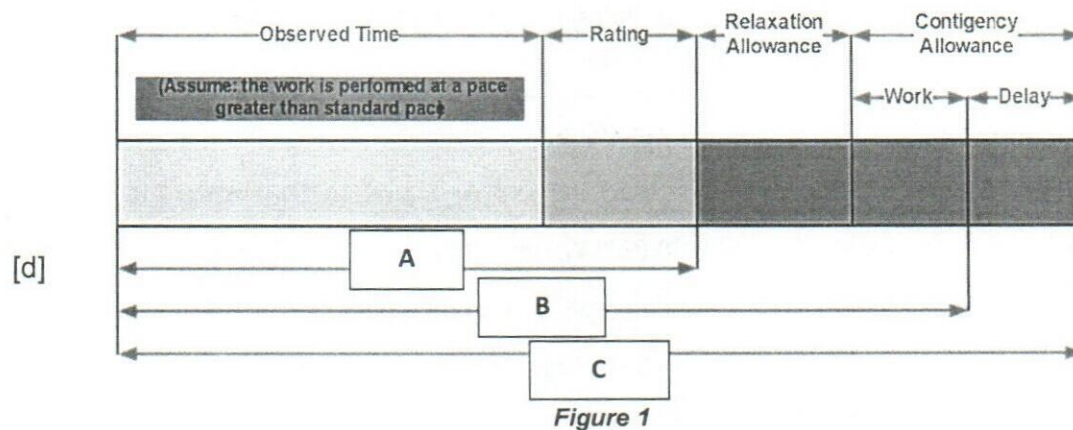
QUESTION 01 [20 MARKS]

- [a] Why is it important to perform a time study on a particular work process? **03 Marks**

Define the terms

- [b] i) Standard Rating **04 Marks**
ii) Standard Performance

- [c] Briefly explain "work study techniques". **04 Marks**



Identify A, B and C in Figure 1.

03 Marks

Table 1: Time Study Data

Activity	Cycle Observation					Performance Rating
	1	2	3	4	5	
Get Casting	0.21	2.31	4.41	6.45	8.59	0.95
Fix into fixture	0.48	2.59	4.66	6.70	8.86	0.90
Drilling operation	1.52	3.65	5.66	7.74	9.90	1.00
Unload	1.73	3.83	5.91	7.96	10.10	0.95
Inspect	1.98	4.09	6.15	8.21	10.30	0.80
Replace	2.10	4.20	6.25	8.34	10.42	1.10

- [e] **06 Marks**

Table 1 shows the time-study data obtained by continuous time measurement. Using a fatigue allowance of 20 percent, compute the standard time.

QUESTION 02 [20 MARKS]

[a] Increased productivity promotes the process of harnessing the capacity to increase the outputs by optimal utilization of all the resources employed at the most economical cost of production, while creating a chain reaction. **Figure 2.1** shows an illustration of this 'Chain Reaction of Increased Productivity'. Redraw and complete the figure in your answer script.

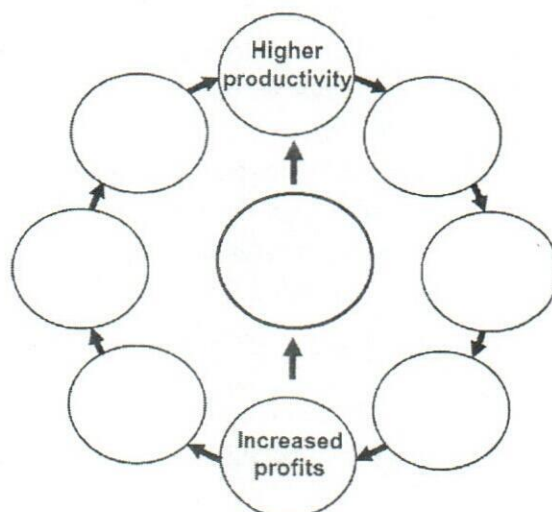


Figure 2.1

05 Marks

[b] State **FOUR** Partial Productivity Measuring (PPM) indices.

04 Marks

[c] Total productivity measure (TPM) or total factor productivity is the ratio of the total tangible outputs of all products and services to the total tangible resource inputs. Differentiate between Total Tangible Outputs and Total Tangible Inputs.

04 Marks

[d] Describe the terms 'Physical Productivity, Functional Productivity, and Economic Productivity'.

03 Marks

[e] In a certain machine shop, an effective preventive maintenance program was introduced. This reduced the total operation and maintenance cost of the machine shop by 20%. Nevertheless, this preventive maintenance program needed regular machine stoppages, reducing the total output by 5%. What is the increase in productivity?

04 Marks

QUESTION 03 [20 MARKS]

[a] State **THREE** ways to maintain inventory accuracy?

03 Marks

[b] What are the Symptoms of Poor Inventory Management?

03 Marks

[c] Items held in inventory are not of equal importance in terms of money invested, profit potential, sales or usage volume, or stockout penalties. Hence control efforts are implemented according to the "Relative Importance" of various items in inventory. By considering the Annual Dollar Value as the measure of relative importance, classify the inventory items shown in **Table 3.1** (provided as a separate sheet with the exam paper) using the **A-B-C Approach**, while showing how you assigned the relative importance. Attach the sheet to your answer script.

08 Marks

[d] Compare the features of a 'Fixed-order quantity model' with a 'Fixed-time period model'.

04 Marks

[e] Find the EOQ using the data provided for a certain time period.

- Demand = 50 units/week
- Weeks per year = 52
- Cost to place an order = \$ 10
- Holding cost per unit per year = \$ 2.5

(Hint: $EOQ = \sqrt{\frac{2DS}{H}}$, where D is the annual demand, S is the order cost, and H is the holding cost per year)

02 Marks

QUESTION 04 [20 MARKS]

[a] What are the Time Horizons of Forecasting?

03 Marks

[b] Discuss the Characteristics, Strengths, and Weaknesses of Qualitative and Quantitative Forecasting Methods.

06 Marks

[c] Time Series Quantitative Forecasting Methods are based on the assumption that past demand follows some pattern, and if that pattern can be analysed, it can be used to develop projections for future demand. Differentiate between a Trend Pattern, a Seasonal Pattern, and a Composite Demand Pattern using appropriate illustrations.

03 Marks

[d] Describe the Delphi Technique of qualitative forecasting.

03 Marks

[e] A company manufactures two types of chain links using different metals.

- A single type A link requires 4 grams of iron, 5 grams of nickel, and 3 grams of aluminium.
- A single type B link requires 5 grams of iron, 2 grams of nickel, and 8 grams of aluminium.
- For a single day, manufacturer receives 1kg of iron, 1kg of nickel, and 1.2kg of aluminium.
- The manufacturer can gain 5 LKR profit for a single type A link and 3 LKR for a single type B link.
- Find the best combination of the quantities of type A and type B links to be produced (for a day) which generates the maximum profit for the manufacturer through Linear Programming.

05 Marks

QUESTION 05 [20 MARKS]

[a] Describe the four stages of a new brand of mobile phone's life cycle.

04 Marks

[b] Compare a process-oriented layout and a product-oriented layout under the following aspects.

- [i] Product
- [ii] Workflow
- [iii] Human skills
- [iv] Inventory
- [v] Effect of breakdown

05 Marks

[c] *"The machine is only half of the problem. Getting the user to use the machine effectively and efficiently is needed"* Discuss why Ergonomics is important for Engineers and how Ergonomics is related to the said statement?

03 Marks

[e] When ergonomics is neglected, it often leads to minor injuries or near misses - the base of the 'Incident Severity' pyramid. If continuously neglected, over time, these can escalate into major injuries or fatalities. By integrating ergonomic principles into safety programs, organizations can reduce the base of the pyramid, lowering overall risk. Illustrate the 'Incident Severity' Pyramid (with 5 levels).

03 Marks

[d] If you are tasked with designing a Smelting Plant, discuss the factors which should be considered to enhance the 'Ergonomics in the workplace' for the employees, considering the Physical, Biological, and Psychological interactions between the humans and the machines?

05 Marks

**** End of the Question Paper ****

**BATCH 04 - SEMESTER 08
RESIT EXAMINATION
SEPTEMBER 2025**

Additional Sheet to provide answers to the Question 03 Part [c]

- Complete the Table 3.1 and attach this sheet to your answer script.

Index No:

Table 3.1

Item #	Item	Annual Demand	Unit Cost (\$)	Annual Dollar Value	Percentage Relative Importance	ABC Classification
1	Clutch Release Bearings	2,500	330			
2	Kingpin Bearings	100	700			
3	Taper Roller Bearings	1,900	500			
4	Taper Roller Bearing Kit	1,500	100			
5	Steering Bearings	3,900	200			
6	Cylindrical Roller Bearings	1,000	915			
7	4 Point Angular Contact Ball Bearings	200	210			
8	Engine Bearings Kit	100	4,000			
9	Tractor Wheel Bearings	800	100			
10	UCF Bearings	900	20			
11	UCP Bearings	800	25			
12	Bell Crank Bush	400	300			
13	Synchronizers	130	2,500			
14	Thrust Bearings	1300	400			
15	UJ Cross	200	3600			
Category		Percentage of Items		Percentage of Overall Value		
Class A Items						
Class B Items						
Class C Items						



Faculty of Engineering & Technology
Department of Mechanical Engineering
BSc Hons (Eng) in Mechanical Engineering / Mechatronic
Engineering Batch 04

Semester 08 First Sit - Final Examination 2025

Module Code	:	ME4324
Module Title	:	Production Engineering, Planning & Control
Date	:	09 th June 2025
Examiners	:	Dr. GIP Perera / Mr. MGJP Fernando
Time Allowed	:	3 Hours (13:30hrs – 16:30hrs)

Instructions to Candidates:

- This is a **closed book** examination. No reference materials are allowed.
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- Marks will be deducted for missing or incorrect measuring units, and failure to adhere to the above instructions.
- You may use a scientific calculator but it must not be programmable.

Question 01 [20 Marks]

[a]	Discuss the Importance of Productivity to the Workforce and Company.	06 Marks																												
[b]	The output of a certain drilling machine is 75 pieces per hour. By providing a certain jig, the input cost is increased by 12%. At the same time, the output for the same operation has increased to 100 pieces per hour. Calculate the increase in productivity.	02 Marks																												
[c]	Discuss four (04) Growth Factors for Productivity	04 Marks																												
[d]	I. Discuss the differences between Qualitative and Quantitative forecasting methods. II. State two (02) Qualitative forecasting methods. III. State two (02) Quantitative forecasting methods.	04 Marks																												
[e]	Consider the demand data points shown in Table 1.1 for 12 periods. Apply a weighted moving average, with weights of 0.5, 0.3, and 0.2 (with the 0.5 weight applied to the most recent demand data). Obtain the Three-period weighted moving average forecast and illustrate the forecasted data graphically. Table 1.1 <table><tr><th>Period</th><th>Demand</th></tr><tr><td>1</td><td>24</td></tr><tr><td>2</td><td>26</td></tr><tr><td>3</td><td>22</td></tr><tr><td>4</td><td>25</td></tr><tr><td>5</td><td>19</td></tr><tr><td>6</td><td>31</td></tr></table> <table><tr><th>Period</th><th>Demand</th></tr><tr><td>7</td><td>26</td></tr><tr><td>8</td><td>18</td></tr><tr><td>9</td><td>29</td></tr><tr><td>10</td><td>24</td></tr><tr><td>11</td><td>30</td></tr><tr><td>12</td><td>23</td></tr></table>	Period	Demand	1	24	2	26	3	22	4	25	5	19	6	31	Period	Demand	7	26	8	18	9	29	10	24	11	30	12	23	04 Marks
Period	Demand																													
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Question 02 [20 Marks]

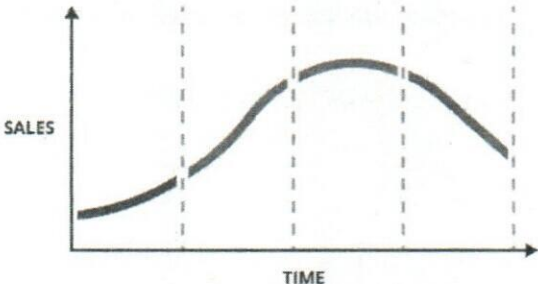
[a]	Discuss four (04) Functions of Inventory and two (02) Reasons Not to Hold Inventory.	06 Marks
[b]	Compare the features of a 'Fixed-order quantity model' with a 'Fixed-time period model'.	08 Marks
[c]	Based on the details provided for a specific product, determine its Economic Order Quantity (EOQ)? ▪ Demand = 30 units/week ▪ Weeks per year = 52 ▪ Cost to place an order = \$ 20 ▪ Holding cost per unit per year = \$ 3 (Hint: $EOQ = \sqrt{\frac{2DS}{H}}$, where D is the annual demand, S is the order cost, and H is the holding cost per year)	02 Marks
[d]	Refer the additional sheet provided with the exam paper which contains Table 2.1. On that paper itself, classify the inventory items shown in Table 2.1 by using the ABC Approach, by the measure of Annual Dollar Value. (You are required to calculate the ADV and fill in the blanks and you can assume the relative importance as preferred). Attach the completed sheet to your answer script.	04 Marks

Question 03 [20 Marks]

[a]	Comment on the following statement. "Rhythm is fine for dancing, but it has no place on the shop floor."	02 Marks
[b]	Briefly explain the purpose of Method Study. You may use at least two examples to elaborate your ideas.	04 Marks
[c]	Explain the purpose of applying performance ratings and allowances in time study.	04 Marks

[d]	Table 3.1: Time Study Data						06 Marks
	Activity	Cycle Observation					Performance Rating
		1	2	3	4	5	
	Get Casting	0.21	2.31	4.41	6.45	8.59	0.95
	Fix into fixture	0.48	2.59	4.66	6.70	8.86	0.90
	Drilling operation	1.52	3.65	5.66	7.74	9.90	1.00
	Unload	1.73	3.83	5.91	7.96	10.10	0.95
	Inspect	1.98	4.09	6.15	8.21	10.30	0.80
	Replace	2.10	4.20	6.25	8.34	10.42	1.10
Table 3.1 shows the time-study data obtained by continuous time measurement. Using a fatigue allowance of 20 percent, compute the standard time.							
[e]	Suppose that you are the Plant Engineer of a blow-moulding plant who takes decisions about the plant operations. Describe four (04) situations under which you must take decisions when running the plant, with suitable example situations.						04 Marks

Question 04 [20 Marks]

[a]	 Figure 4.1 - Redraw the Product Life Cycle graph shown in Figure 4.1 in your answer script and name the four (04) stages of a product life cycle. - Elaborate how the sales volume and profit change over time under each stage.	05 Marks
[b]	Compare a process-oriented layout and a product-oriented layout under the following aspects. - Product - Workflow - Human skills - Inventory - Effect of breakdown	05 Marks

[c]	Describe how Linear Programming can be used to solve optimisation problems and state three (03) applications where LP can be used.	05 Marks
[d]	A manufacturer produces two types of vehicle doors D1 and D2. Each D1 model requires 3 hours of grinding and 3 hours of polishing, whereas each D2 model requires 4 hours of grinding and 2 hours of polishing. The manufacturer has 2 grinders and 2 polishers. Each grinder works for 50 hours a week, and each polisher works for 40 hours a week. Profit on an D1 model is 20\$ and on an D2 model is 35\$. Whatever is produced in a week is sold to the vehicle assembly plants. - Develop the mathematical relationships to describe how should the manufacturer allocate his production capacity to the two types of doors so that he may make the maximum profit in a week. - Sketch the pictorial representation of the LPP to show the solution space.	05 Marks

Question 05 [20 Marks]

[a]	Provide a definition for the term 'Ergonomics'.	02 Marks
[b]	Elaborate the 'Principle of User-Centred Design' and the factors which defines a successful design.	05 Marks
[c]	Discuss the features that should be included in an ergonomically designed Safety Helmet.	04 Marks
[d]	What are the consequences of poor ergonomics in a workplace?	03 Marks
[e]	As a Workshop Engineer of a company which produces metal fastener (nuts and bolts), you are tasked with expanding the production capacity by building a series of Lathe Machine Workshops. Discuss the factors which should be considered to enhance the 'Ergonomics in the workplace' in all these workshops considering the Physical, Biological, and Psychological interactions between the humans and the machines?	06 Marks

End of the Question Paper

Batch 04**Semester 08 First Sit - Final Examination 2025****Additional Sheet to provide answers to the Question 02 Part [d]**

- Complete the table and attach this sheet to your answer script

Index No:

Table 2.1

Item Number	Annual Demand	Unit Cost	Annual Dollar Value	ABC Classification
1	2,500	330		
2	100	700		
3	1,900	500		
4	1,500	100		
5	3,900	700		
6	1,000	915		
7	200	210		
8	1,000	4,000		
9	800	100		
10	900	2		
11	500	200		
12	400	300		



Faculty of Engineering & Technology
Department of Mechanical and Manufacturing
BSc. Hons. (Eng.) in Mechanical Engineering
Semester 2 First Sit - Final Examination 2026

Batch: 08

Module Code: ME1323	Module Title: Thermodynamics
Date: 27[April]2026	Duration: 3 hours
Examiner 1: Examiner 2:	Miss. K. Nileeka Priyadarshani

Instructions to Candidates:

- This is a closed book examination. No reference materials are allowed unless specified.
- This paper consists of four (5) questions and 6 pages. Answer all questions.
- The marks allocated to each question are listed in the column on the far right. Final mark of the question paper will be calculated out of 100.
- Use only the provided answer booklet, additional sheets, and graph papers for your answers.
- Write clearly and legibly. Use a blue or black pen only.
- Write your student number on all sheets.
- Start each question on a new page in the answer booklet, answer sheets. Clearly indicate the question number at the top of the page.
- If parts of the same question are written discontinuously in non-consecutive sheets, ensure that each part is relevantly labelled with its corresponding question number.
- You can only use a scientific calculator. This must not be programmable and may be inspected during the examination.

Q1 i) Briefly explain the difference between extensive and intensive properties by providing three examples of each. [04]

ii) By considering the behaviour of an ideal gas in a piston-cylinder system, analyze separately the heat transfer during a constant-volume process and a constant-pressure process to derive the relationship, $C_p - C_v = R$, Where: [06]

C_p = Heat capacity at constant volume

C_v = Heat capacity at constant pressure

R = Gas constant for ideal gas

iii) Steam enters a steady-flow turbine with a mass flow rate of 15 kg/s, and at a temperature of 600°C, a pressure of 5 MPa, and a negligible velocity. The steam expands through the turbine to a saturated vapour state at 10 kPa.

a) If the turbine operates under adiabatic conditions, determine the work done by the steam during this process. [07]

b) Illustrate the process on a T-V diagram. [03]

Total [20]

Q2. i) A frictionless piston-cylinder device undergoes a polytropic process from an initial thermodynamic state 1 to a final thermodynamic state 2. If the boundary work done during the process is 'W', then derive the relationship, [04]

$$W = \frac{1}{(1-n)} (P_2 V_2 - P_1 V_1)$$

It is given that $PV^n = \text{constant}$ describe the polytropic process.

Where:

n = Polytropic index

P_1, V_1 = Pressure and volume of the system at thermodynamic state 1

P_2, V_2 = Pressure and volume of the system at thermodynamic state 2

ii) For the above process in Q2. i), if the temperature and pressure is denoted by T and P respectively, show that; [04]

$$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}}$$

iii) A mass of 0.3 kg of nitrogen gas is at a pressure of 100 kPa and temperature of 40°C contained in a cylinder with a movable piston. The piston is then moved, so as to compress the nitrogen gas until the pressure increases to 1 MPa and the temperature rises to 160°C. During this process, the work done is 30 kJ. Sketch the compression [12]

2 of [6]

process in a p-v diagram, and calculate the amount of heat transferred from the nitrogen gas to the surroundings. Refer **Table 1**.

Total [20]

- Q3.**
- i) State the Clausius Statement of second law of thermodynamics. [02]
 - ii) What is meant by a pure substance in thermodynamics? Explain the conditions to be satisfied by a substance that to be considered as the pure substance. Use the appropriate example to explain your answer. [07]
 - iii) The interior light of a refrigerator is provided by a 40W incandescent lamp that is normally switched ON only when the refrigerator door is opened. Due to a malfunction of the door switch, the lamp remains continuously ON even though the door is closed. The refrigerator operated by motor-compressor assembly with a coefficient of performance (COP) of 1.3. The operating cost of electricity is Rs.8.00 per kWh. Assuming that the refrigerator door is opened 20 times per day for an average duration of 30s each time, determine the increase in the refrigerator's energy consumption and the corresponding additional electricity cost per year, if the switch remains unrepaired. [11]
- Total [20]**
- Q4.**
- i) List the modes of heat transfer and explain each mode briefly. [04]
 - ii) What is Fourier's law of heat conduction? State the equation governing heat conduction according to this law. [04]
 - iii) A furnace wall consists of 200 mm layer of refractory bricks, 6 mm layer of steel plate and a 100 mm layer of insulation bricks. The maximum temperature is 1150°C on the furnace side and the minimum temperature 40°C on the outermost side of the wall. An accurate energy balance over the furnace shows that the heat loss across the wall is 400 W/m². It is known that there is a thin layer of air between the layers of refractory bricks and steel plate. Refer **Table 2**.
 - a) Determine the equivalent thickness of the air layer (in millimeters) that provides the same thermal insulation effect as a standard insulation brick. [06]
 - b) What is the temperature of the outer surface of the steel plate? [06]
- Total [20]**
- Q5.**
- i) List and explain three fundamental assumptions made in modeling and air-standard cycle. [04]
 - ii) Classify reciprocating engines into two main types. Then, describe the working principle of one of the above types by outlining the sequential steps that constitute a complete cycle. [07]
 - iii) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27°C respectively. The amount of heat added to the air per cycle is 1500 kJ/kg.
 - a) Determine the pressures and temperatures at the key state points of the air-standard Otto cycle, making use of the ideal-gas relations and the cycle assumptions. [07]

- b) Calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8:1. Refer **Table 1**. [02]

Total [20]

Table 1 – [Material Properties]

c_v for nitrogen	0.75 kJ/kg.K
c_v for air	0.72 kJ/kg.K
γ for air	1.4

Table2 – [Conductivity of Materials]

Refractory bricks	1.52 W/m°C
Insulation bricks	0.138 W/m°C
Steel plate	45 W/m°C

End of the Question Paper



FACULTY OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
BSC HONS (ENG) IN MECHANICAL ENGINEERING
BATCH 05 - SEMESTER 08
END SEMESTER EXAMINATION
August 2026

Module Code	:	ME4324
Module Title	:	Production Engineering, Planning & Control
Date	:	10 th August 2026
Examiners	:	Prof. G. I. P. Perera
Time Allowed	:	3 Hours (13:30hrs – 16:30hrs)

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- Write your student number on **ALL** sheets.
- Use a **graph sheet** to answer the Question 02 [b] II.
- ***Start each question on a new page in the answer booklet. Clearly indicate the question number at the top of the page.***
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- You may use a scientific calculator but it must not be programmable.

QUESTION 01 [20 MARKS]

- [a] Discuss the importance of productivity at three levels:
- I. the operators or workforce
 - II. the company
 - III. the nation
- [b] A service centre generated revenue of \$120,000 in Year 1 and \$150,000 in Year 2. The inputs are given in Table Q1.
- I. Calculate labour productivity, spare parts productivity, and multi-factor productivity for both years.
 - II. Based on your calculations, determine whether productivity has improved and justify your conclusion.

06
Marks08
Marks**Table Q1**

Input Category	Year 1	Year 2
Labour	60,000	70,000
Spare Parts	25,000	30,000
Equipment Depreciation	8,000	9,000

- [c] Explain product layout, process layout, and fixed-position layout with suitable examples.

06
Marks**QUESTION 02 [20 MARKS]**

- [a] Discuss three uses of short-term forecasting.
- [b] Table Q2 shows the weekly demand data for a product:

06
Marks**Table Q2 Weekly demand data**

Week	Demand
1	580
2	720
3	630
4	780
5	780
6	960
7	850
8	1,100
9	960
10	

14
Marks

- I. Forecast the demand for the 10th week using the exponential smoothing method with a smoothing constant of 0.3. (Assume $F_1 = D_1$)
- II. Plot the forecast data and the demand in one graph and comment on the demand behaviour. (Use the graph sheet provided)
- III. Compute the forecast error using the Mean Absolute Deviation (MAD) Method.

QUESTION 03 [20 MARKS]

- [a] Define Work Measurement and discuss its' importance. 03 Marks
- [b] Explain the followings in connection with time study. 06 Marks
- Cumulative Time Methods
 - Fly Back Timing
- [c] In what ways can method study be used to minimize ergonomic strain and reduce operator fatigue on a sewing production floor? 05 Marks
- [d] An operator is assembling a telephone charger, and the recorded actual (observed) time for completing the task is 2.00 minutes. The performance rating assigned to the worker is 110%. 06 Marks
- Calculate the basic time for the operation.
 - If the job is given three types of allowances shown below, determine the standard time required for the operation. (Personal 5%, Fatigue 5% and Delay 3%)

QUESTION 04 [20 MARKS]

Consider a project involving the following activities and precedence relationship. The cost of each activity is listed.

Table Q4

Activity	Precedence Activity	Cost per week (\$/week)	Duration (weeks)		
			Optimistic (a)	Most Likely (m)	Pessimistic (b)
A	-	5000	2	3	5
B	A	3000	3	5	8
C	A	6000	4	6	9
D	B	2000	1	2	4
E	C	4000	3	4	7
F	D	7000	1	2	4
G	D	4000	2	3	5
H	G	8000	1	2	3
J	B, E	6000	4	6	8
K	E, F, H	5000	2	4	7
L	J	3000	2	3	6

- [a] Calculate the expected time for each activity. 02.5 Marks
- [b] Draw the network diagram. 07 Marks
- [c] Identify the critical path. 03 Marks
- [d] Show the earliest start, earliest finish times, latest start, and latest finish times. 05 Marks
- [e] Calculate slack values for each activity. 02.5 Marks

QUESTION 05 [20 MARKS]

- [a] What is “EOQ model” in inventory management?
- [b] Find the economic order quantity using the data provided for a certain time period.

05
Marks

Demand	= 50 units/week
Weeks per year	= 52
Cost to place an order	= \$ 10
Holding cost per unit per year	= \$ 2.5

05
Marks

Hint: $EOQ = \sqrt{\frac{2DS}{H}}$

- [c] Material Requirements Planning (MRP) is integral to sustaining an uninterrupted supply.

Boeing Inc., a global leader in aerospace manufacturing, has received an order for 60 units of Boeing 737 Wing Assembly (X) to be delivered in 8 weeks. Boeing Inc. currently has 150 units of Aluminium Alloy Sheets (M) and 200 units of Composite Panels (P) in stock. No inventory is available or on order for other components. The product structure tree for Wing Assembly is provided in Figure Q5.

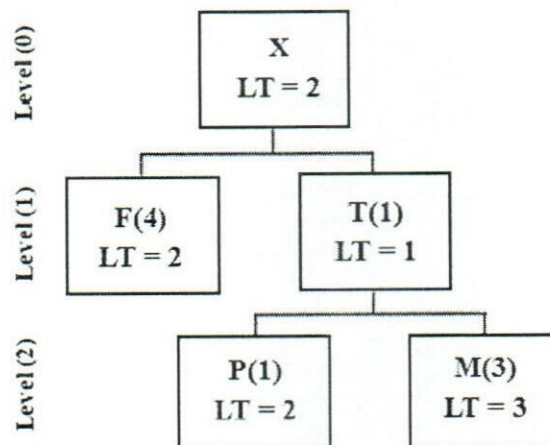
10
Marks

Figure Q5 The product structure tree

- Determine the planned order release for Boeing 737 Wing Assembly.
- Calculate the total material requirements for all subassemblies and raw materials.

Use the MRP table provided to construct the above answers.

****** End of the Question Paper ******

