

BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING) FOURTH YEAR SECOND SEMESTER EXAM 2025

SUBJECT: INDUSTRIAL MANAGEMENT

Time: 3 Hours

Full Marks: 100

Assume any relevant data, if necessary. Symbols in the Question Paper carry their usual meanings. Figures in the margin indicate full marks. All Parts of any one question must be answered together.

Answer strictly to the point.

ANSWER ANY FOUR QUESTIONS.

Q1. a) Silicon Chips, Inc., maker of superfast DRAM chips, wants to categorize its 10 major inventory items using ABC analysis.

Item	Stock Number	Annual Volume (Units)	Unit Cost (\$)
1	#01036	100	8.5
2	#01307	1200	0.42
3	#10286	1000	90
4	#10500	1000	12.5
5	#10572	250	0.6
6	#10867	350	42.86
7	#11526	500	154
8	#12572	600	14.17
9	#12760	1550	17
10	#14075	2000	0.6

b) Chris Beehner Electronics stocks toy remote control flying drones. Recently, the store has been offered a quantity discount schedule for these drones. This quantity schedule is shown in the following table. Furthermore, setup cost is \$200 per order, annual demand is 5,200 units, and annual inventory carrying charge as a percent of cost, I , is 28%. What order quantity will minimize the total inventory cost?

Quantity Ordered (number)	Price Per Drone (\$)
1-199	100
120-1,499	98
1500 & above	96

12+13 = 25

Q2. a) Ross Hopkins, president of Hopkins Hospitality, has developed the tasks, durations, and predecessor relationships in the following table for building new motels. Draw the AON network and answer the questions that follow.

[Turn over

Activity	Immediate Predecessor	Time estimates (in weeks)		
		Optimistic	Most	Pessimistic
A	—	4	8	10
B	A	2	8	24
C	A	8	12	16
D	A	4	6	10
E	B	1	2	3
F	E, C	6	8	20
G	E, C	2	3	4
H	F	2	2	2
I	F	6	6	6
J	D, G, H	4	6	12
K	I, J	2	2	3

- What is the expected (estimated) time for activity C?
- What is the variance for activity C?
- Determine the earliest and latest start and finish times for all activities.
- Based on the calculation of estimated times, what is the critical path?
- What is the estimated time of the critical path?
- What is the activity variance along the critical path?
- What is the probability of completion of the project before week 42? (use Appendix 1)

b) State the advantages and limitations of PERT (Program evaluation and review technique).

20+5 = 25

Q3. a) Nodel Construction Company renovates old homes in West Bloomfield, Michigan. Over time, the company has found that its dollar volume of renovation work is dependent on the West Bloomfield area payroll.

i) Management wants to establish a mathematical relationship to help predict sales.

ii) The management also wants to know the Coefficient of Correlation between the variables.

n	Nodel's Sales (In \$ Millions), y	Area Payroll (In \$ Billions), x
1	2	1
2	3	3
3	2.5	4
4	2	2
5	2	1
6	3.5	7

b) The following data come from regression line projections:

Period	Forecast Values	Actual Values
1	410	406
2	419	423
3	428	423
4	435	440

Compute the Mean Absolute Deviation (MAD) and Mean Squared Error (MSE).

17+8 = 25

Q4. a) Solve the following LPP using simplex method

$$\text{Maximize } Z = 16x_1 + 17x_2 + 10x_3$$

Subjected to the constraints:

- i. $x_1 + x_2 + 4x_3 \leq 2000$
- ii. $2x_1 + x_2 + x_3 \leq 3600$
- iii. $x_1 + 2x_2 + 2x_3 \leq 2400$
- iv. $x_1 \leq 30$

and $x_1, x_2, x_3 \geq 0$

b) The Glickman Electronics Company in Washington, DC, produces two products: (i) the Glickman x-pod and (ii) the Glickman BlueBerry. The production process for each product is similar in that both require a certain number of hours of electronic work and a certain number of labor-hours in the assembly department. Each x-pod takes 4 hours of electronic work and 2 hours in the assembly shop. Each BlueBerry requires 3 hours in electronics and 1 hour in assembly. During the current production period, 240 hours of electronic time are available, and 100 hours of assembly department time are available. Each x-pod sold yields a profit of \$7; each BlueBerry produced may be sold for a \$5 profit.

Determine the best possible combination of x-pods and BlueBerrys to manufacture to reach the maximum profit using graphical method.

18+7 = 25

Q5. a) Distinguish between product layout and process layout.

b) What is span of control? Discuss about a tall and a short organization structure with the help of span of control.

c) List the factors you would consider while setting up a green field Oil Refinery.

d) How did F.W. Taylor contribute to the development of management thoughts and ideas?

6+6+7+6 = 25

Q6. a) Smithson Cutting is opening a new line of scissors for supermarket distribution. It estimates its fixed cost to be \$500.00 and its variable cost to be \$0.50 per unit. Selling price is expected to average \$0.75 per unit. **i)** What is Smithson's break-even point in units? **ii)** What is the break-even point in dollars?

b) What are seven tools of TQM?

c) What is the purpose of using a Pareto chart for a given problem?

d) How to decide that when and where to inspect?

8+4+6+7 = 25

APPENDIX I

Normal Curve Areas

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97784	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997