

**B.Tech. MECHANICAL ENGINEERING  
(COMPUTER INTEGRATED  
MANUFACTURING)**

**Term-End Examination**

00933

**June, 2018**

**BME-035 : INDUSTRIAL ENGINEERING AND  
OPERATIONS RESEARCH**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : All questions carry equal marks. Attempt any **four** questions from Section A and any **three** questions from Section B. Use of scientific calculators is allowed.*

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**SECTION A**

*Answer any **four** questions.*

1. (a) Explain how the industrial engineering department collaborates with other departments. 5
- (b) Describe integration of technology with suitable example. 5

- 2. (a)** Distinguish between time study and work sampling. 5
- (b)** Describe the ergonomic conditions and guidelines for body postures to maximize the output. 5
- 3. (a)** Explain the requirements of a good product design. 5
- (b)** Discuss the concept of reverse engineering in product design and development. 5
- 4. (a)** Explain the role of system performance in Man-Machine relationship. 5
- (b)** What is the difference between production and productivity? 5
- 5. (a)** What is multi-criteria decision making approach? 5
- (b)** What is meant by degeneracy in LPP? When does it occur? 5
- 6. (a)** How can the reliability of a product be improved? 5
- (b)** Distinguish between games with saddle points and without saddle points. 5

## SECTION B

7. A and B play a game in which each has three types of coins, 5P, 10P and 20P. Each selects a coin without the knowledge of the others choice. If the sum of the coin value is an odd amount, A wins. If the sum of the coin value is an even amount, B wins. Find the best strategy for each player and the value of the game. 10
8. An oil refinery can blend three grades of crude oil to produce petrol quality P and Q. Two possible blending processes are available. For each production run, the older process uses 5 units of crude A, 7 units of crude B and 2 units of crude C to produce 9 units of P and 7 units of Q. The new process uses 3 units of crude A, 9 units of crude B and 4 units of crude C to produce 5 units of P and 9 units of Q petrol. Because of prior contract commitments, the refinery must produce at least 500 units of P and at least 300 units of Q for the next month. It has available 1500 units of crude A, 1900 units of crude B and 1000 units of crude C. For each unit of P the refinery receives ₹ 60 while for each unit of Q it receives ₹ 90. Formulate the linear programming problem so as to maximise the revenue. Solve the problem using the graphical method. 10

9. Solve the following LPP using the Simplex method. Maximize  $z = 10x_1 + 8x_2$  subject to  $x_1 + 2x_2 \leq 1000$ ;  $x_1 \leq 300$ ;  $x_2 \leq 500$ ;  $x_1, x_2 \geq 0$ . 10

10. Find the optimal solution to the following transportation problem. Given unit cost 10

	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply
O <sub>1</sub>	15	19	15	22	22
O <sub>2</sub>	19	13	18	17	17
O <sub>3</sub>	21	12	16	15	15
Demand	20	25	16	35	

11. A trip from Hyderabad to Warangal takes 6 hours by bus. A typical time table of bus services in both directions is given below :

Hyderabad–Warangal			Warangal–Hyderabad		
Route No.	Departure	Arrival	Route No.	Departure	Arrival
a	06 : 00	12 : 00	1	05 : 30	11 : 30
b	07 : 30	13 : 30	2	09 : 00	15 : 00
c	11 : 30	17 : 30	3	15 : 00	21 : 00
d	19 : 00	01 : 00	4	18 : 30	00 : 30
e	00 : 30	06 : 30	5	00 : 00	06 : 00

The cost of providing this service by the transport company depends upon the time spent by the bus crew (driver and conductor) away from their places in addition to service times. There are five crews. There is a constraint that every crew should be provided with 4 hours of rest before the return trip again and should not wait for more than 24 hours for the return trip. The company has residential facilities for the crew at Hyderabad as well as at Warangal. Obtain the pairing of routes so as to minimise the cost.

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