

Con. 6527-11.

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Solve any **five** questions including question number **one** is **compulsory**.
 (2) **All** question carry **equal** marks.
 (3) Use on **non-programmable** calculators and log table **allowed**.
 (4) **Figures to right** indicate **full** marks.
 (5) Assume **suitable** data wherever necessary and mention it **clearly**.



- Q. 1 Attempt any four: [20]
 (i) Framework of MPC system with function of each module.
 (ii) Input-Output analysis
 (iii) Nervousness in MRP system iv) Assumptions of job sequencing
 (v) Vendor relationship vi) JIT v/s MRP

Q.2(A) A manufacturer specializing in the production of gears intend to add two more types of gears to existing product line. Both the types of gears will be work3ed in the blanking shop and gear cutting shop. Each gear type A requires 20 minutes in the blanking shop and 40 minutes in the gear shop. Each gear type B requires 10 minutes in the blanking shop and 10 minutes in the gear shop. The blanking shop and gear shop have respectively 1200 minutes and 1600 minutes available per week. The marginal profit for each gear of type A is Rs. 10 per unit and for each gear of type B is Rs. 4 per unit. The manufacturer is in the market upswing and can sell as much as he can produce. How many units of each type of he should produce to maximize his profits? What will be the resulting profit then? If he wish to expand the capacity of any one of the shop, which shop he should select and to what extent the capacity should be expanded? (Solve the problem by simplex iteration only). Also write the dual of the LPP. [15]

(B) XYZ company produces two end products which will process through two departments viz assembly & welding shop. Product A takes one half hour to assembly & one hour of welding time for the parts. Product B requires one hours of assembly & two hours of welding. What are capacity requirements in assembly & welding for the following MPS. [5]

| Quarter | 1 | 2 | 3 | 4 |
|-----------|-----|-----|-----|-----|
| Product A | 250 | 400 | 300 | 700 |
| Product B | 180 | 150 | 150 | 700 |

Q.3[A] A manufacturing facility has five jobs to be scheduled into operation. The following table shows the processing time plus necessary wait times & other necessary delays for each of the jobs. Assume that today is April 3 & the jobs are due on the dates shown. [10]

| Job | Days of actual processing times required | Days of necessary delay time | Date job due |
|-----|--|------------------------------|--------------|
| 1 | 2 | 12 | April 30 |
| 2 | 5 | 8 | 21 |
| 3 | 9 | 15 | 28 |
| 4 | 7 | 9 | 29 |
| 5 | 4 | 22 | 27 |

Find

- (i) Determine the sequence of the jobs using the following priority sequencing rule (a) SOT (b) EDD (c) FCFS (d) Critical ratio.
 (ii) Calculate the (a) Average flow time (b) Average job lateness (c) Average number of jobs in the system by applying any one of the above rule.

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[B] Using the following data estimate sales forecast for the 9th year assuming linear trend & by exponential smoothening if $\alpha = 0.3$. [10]

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|----|----|----|----|----|----|----|----|
| SalesX 1000 | 50 | 48 | 49 | 50 | 53 | 51 | 55 | 60 |

Q.4[A] Consider the following information about an end product item [10]

Ordering cost = Rs. 32/order

Average usage = 8 units/week

Inventory carrying cost = Rs.2/unit/week

- (i) Determine the number of orders that should be placed per year (52 weeks/year) to replenish the inventory of the item on the average weekly demand.
- (ii) Given the following time phased weekly requirements from an MRP record for this item. Determine the sequence of planned orders using EOQ & POQ procedures. Assume that lead time equals to zero. Calculate the inventory carrying cost on the basis of weekly ending inventory or weekly average inventory values. Which procedure produces the lowest total cost for the eight week period.

| Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|------|----|---|----|----|---|---|----|---|
| NR | 15 | 2 | 10 | 12 | 6 | 0 | 14 | 5 |

[B] Solve the following transportation problem for minimize cost. [10]

| | Market | | | Availability at warehouse |
|----------------------|--------|----|----|---------------------------------|
| | 1 | 2 | 3 | |
| Warehouse | 1 | 6 | 4 | 50 |
| | 2 | 3 | 8 | 40 |
| | 3 | 4 | 4 | 60 |
| Demand in the market | 20 | 95 | 35 | |

Q.5 A The table gives details of activities of a project. [10]

| Activity | Preceding Activity | Duration days |
|----------|--------------------|---------------|
| A | - | 8 |
| B | - | 12 |
| C | - | 7 |
| D | A | 3 |
| E | A | 5 |
| F | A | 12 |
| G | B | 9 |
| H | D,B | 7 |
| I | C,E | 4 |
| J | C,E | 2 |
| K | H,F,I | 6 |
| L | J,K | 10 |

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(a) Draw the network using the above table. Find the critical path and its length

(b) At the 15 the end it was observed that:-

- (i) Activities A,B,C,D and E are completed
- (ii) Activity F is in progress and need 3 more days for completion
- (iii) Activity H is in progress and need 5 more days for completion
- (iv) Activity J is yet to start & requires revised estimate of 5 days
- (v) Activity I is in progress and need 2 more days for completion
- (vi) Activity K can be completed in 3 days according to revised estimate
- (vii) Activity L can be completed in 7 days

Draw the revised network using the above information & find the critical path and its length.

B] In a small workshop there are five jobs to be done on four work centers. The [10]
following matrix gives number of days required for each job on every work center. The owner
has to complete at least any four jobs in minimum number of days. Hence based on the
following matrix, choose any four jobs to be loaded on four work centre. So that total number of
days for completion of four jobs is minimum.

| Job | Work Centres | | | |
|-----|--------------|----|----|----|
| | W | X | Y | Z |
| A | 10 | 9 | 8 | 12 |
| B | 3 | 4 | 5 | 2 |
| C | 25 | 20 | 14 | 16 |
| D | 7 | 9 | 10 | 9 |
| E | 18 | 14 | 16 | 25 |

Q.6 (A) Mike Blanford, the master scheduler at General Avionics, has the following [12]
demand forecast for one of the lines in his factory.

| Quarter | Unit sales |
|---------|------------|
| 1 | 5,000 |
| 2 | 10,000 |
| 3 | 8,000 |
| 4 | 2,000 |

At the beginning of January, there are 1000 units in inventory. The following data have been prepared by the firm:

| | |
|--------------------------|---------------------------|
| Hiring cost per employee | = Rs200/- |
| Firing cost per employee | = Rs400/- |
| Beginning workforce | = 60 employees |
| Inventory carrying cost | = Rs.2/unit/quarter |
| Stock-out cost | = Rs5/unit/quarter |
| Regular payroll | = Rs1200/employee/quarter |
| Overtime cost | = Rs2/unit. |

Each employee can produce 100 units per quarter. Demand not satisfied in any quarter is lost & incurs a stock-out penalty. If Mike produces exactly enough to meet demand each quarter, with no inventories at the end of quarters, & no overtime, how much will he produce each quarter, & what is the overall cost?

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Also calculate the production amounts & costs for a level rate of output with no ending inventory.

[B] Use graphical method to minimize the time required to process the following jobs on the machines. For each machine the job which should be done first. Also calculate the total elapsed time to complete the job. [08]

| | | Machines | | | | |
|-------|-------------|----------|---|---|---|---|
| Job 1 | Sequence: | A | B | C | D | E |
| | Time (hrs): | 2 | 3 | 4 | 6 | 2 |
| Job 2 | Sequence: | C | A | D | E | B |
| | Time (hrs): | 4 | 5 | 3 | 2 | 6 |

Q.7 Explain the following [Any Four]: [20]

- (i) Management activities supported by MPC
- (ii) Infinite & Finite Loading
- (iii) Time estimates in PERT.
- (iv) Monto Carlo Technique
- (v) Gantt Chart

| Job | M1 | M2 | M3 | M4 | M5 |
|-----|----|----|----|----|----|
| A | 10 | 8 | 12 | 15 | 18 |
| B | 12 | 10 | 14 | 16 | 19 |
| C | 14 | 11 | 13 | 17 | 20 |
| D | 15 | 12 | 15 | 18 | 21 |
| E | 18 | 14 | 16 | 20 | 24 |

| Quarter | 1st Unit sales | 2nd Unit sales |
|---------|----------------|----------------|
| 1 | 2000 | 2000 |
| 2 | 10000 | 10000 |
| 3 | 8000 | 8000 |
| 4 | 10000 | 10000 |

At the beginning of January, there are 1000 units in inventory. The following costs have been prepared by the firm:

- Regular payroll = Rs 1200 per employee-quarter
- Overtime cost = Rs 2/unit
- Stock-out cost = Rs 5/unit-quarter
- Inventory carrying cost = Rs 2/unit-quarter
- Beginning workforce = 50 employees
- First cost per employee = Rs 400
- Hiring cost per employee = Rs 200

Employee can produce 100 units per quarter. Demand is not known in any quarter, is lost & incur a stock-out penalty. If Mike produces exactly enough to meet demand each quarter with no new orders at the end of quarter, & no overtime, how much will he produce each quarter & what is the overtime cost?