REVISIONARY TEST PAPER

DECEMBER 2010

GROUP II

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GROUP - II

Paper-9 : OPERATION MANAGEMENT AND INFORMATION SYSTEM

INTERMEDIATE EXAMINATION

(REVISED SYLLABUS - 2008)

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Paper-9 : OPERATION MANAGEMENT AND INFORMATION SYSTEMS

Section I : Operation Management

Q. 1. (a) Indicate whether the following statements are *True/False* :

(i) Annealing involves heating and cooling operations.

(ii) Industrial Engineering is a line function.

(iii) Group Layout is ideal for mass production.

(iv) Factor Comparison is a method of job evaluation.

(v) Increased production always leads to increased productivity.

(vi) Efficiency is 'doing right things.'

(vii) MRP is a marketing technique.

(viii) Organic Coatings are commonly used to improve resistance to corrosion.

(ix) No handling is best handling.

(x) Linear Programming can solve problems involving variable not capable of being expressed in quantitative terms.

(xi) A slack variable represents unused capacity.

(xii) AFTWAYS is a system of Value Analysis.

(xiii) Dummy Activities are used in Network Analysis.

(xiv) Free Float= Independent float- Head Event Slack.

(xv) LOB is a device for planning and monitoring the progress of an order, project, or programme to be completed by a target data.

Q. 1. (b) Expand the following acronyms :

(i) OCC

(ii) IPPS

(iii) LOB

(iv) AQL

(v) MTBF

(vi) ERP

(vii) VFM

(viii) BOLT

(ix) SCM

(x) AGVs

Answer 1. (a)

(i) True.
(ii) False — Industrial Engineering is a staff function.
(iii) False.
(iv) True.
(v) False.
(vi) False — It is 'doing things right'.
(vii) False — It is a production technique.
(viii) True.
(ix) True.
(x) False.
(xi) True.
(xii) False — It is a type of predetermined motion time systems.
(xiii) True.
(xiv) False — Free Float = Total float- Head Event Slack.
(xv) True.

Answer 1. (b)

(i) Operating Characteristic Curve.
(ii) Integrated Production Planning System.
(iii) Line Of Balance.
(iv) Acceptable Quality Level
(v) Mean Time Between Failures.
(vi) Enterprise Resource Planning.
(vii) Value for Money
(viii) Built, Operate , Lease and Transfer.
(ix) Supply Chain Management.
(x) Automated Guided Vehicles.

Q. 2. (a) Fill in the blanks with appropriate words :

(i) Lathe is a _____ purpose machine tool.
(ii) _____ is a process that bakes on a white, brittle finish.
(iii) Standard time is always more than _____ time.
(iv) Method Study should _____ work measurement.
(v) _____ cannot be delegated.
(vi) Acceptance number is the maximum number of _____ items in a sample.
(vii) _____ layout is most suitable for job production.
(viii) Gantt chart is used for _____ control.
(ix) Total output of all sectors is _____ total input of all sectors.
(x) Shift working is suitable in case of _____ intensive technology.
(xi) A slack variable represents _____ capacity.

(xii) Average time per cycle declines _____ with number of cycles.

(xiii) The _____ schedule will contain only key milestones.

(xiv) Installed capacity should be based on number of _____ .

(xv) Kaizen is essential part of _____ .

Q. 2. (b) Match each item in Column A with appropriate item in Column B :

Column A	*Column B*
(A) Kanban	**(i) Metal Cutting**
(B) FSN Analysis	**(ii) Investment decision**
(C) SIMO Chart	**(iii) Flow Control System**
(D) Payback period	**(iv) Work Study**
(E) Broaching	**(v) Micro motion study**
(F) Failure Analysis	**(vi) Job holding service**
(G) Tail Stock	**(vii) Priority Rules**
(H) Productivity	**(viii) Maintenance System**
(I) SOT	**(ix) Inventory Control**
(J) Robotics	**(x) Automation**

Answer 2. (a)

(i) general
(i) Enamelling
(iii) normal
(iv) precede
(v) Responsibility
(vi) defective
(vii) Process
(viii) production
(ix) equal to
(x) capital
(xi) unused
(xii) exponentially
(xiii) RAT
(xiv) shifts
(xv) TQM i.e. Total Quality Management

Answer 2. (b)

(A) — (iii)
(B) — (ix)
(C) — (v)
(D) — (ii)
(E) — (i)
(F) — (viii)

(G) — (vi)
(H) — (iv)
(I) — (vii)
(J) — (x)

Q. 3. Choose the most correct alternative :

(i) Cost Reduction can be achieved through :
- **(a) Work Sampling**
- **(b) Value Analysis**
- **(c) Quality Assurance**
- **(d) Supply Chain management**

(ii) Linear Programming is a technique used in :
- **(a) Plant Layout**
- **(b) Production Programme**
- **(c) Product Mix**
- **(d) Manufacturing Sequence**

(iii) Tempering is a process of :
- **(a) Joining**
- **(b) Heat Treatment**
- **(c) Surface Treatment**
- **(d) Forming**

(iv) Relaxation Allowances are considered in :
- **(a) Time Study**
- **(b) Method Study**
- **(c) Ergonomic Study**
- **(d) Feasibility Study**

(v) Buffer Stock is built to cater to :
- **(a) Machine Breakdown**
- **(b) Import Substitution**
- **(c) Fluctuating load**
- **(d) Diversification**

(vi) Jigs are used in machine tool for holding :
- **(a) tools**
- **(b) work piece**
- **(c) head stock**
- **(d) tail stock**

(vii) MRP stands for :
- **(a) Material Requirement Planning**
- **(b) Material Reordering Planning**
- **(c) Material Requisition Planning**
- **(d) Material Recording Planning**

(viii) Specifying the order in which individual jobs are to be executed :

(a) Planning

(b) Loading

(c) Sequencing

(d) Routing

(ix) Ergonomics is another name of :

(a) Chemical Engineering

(b) Human Engineering

(c) Mechanical Engineering

(d) Electrical Engineering

(x) Addition of value to raw materials through application of technology is :

(a) Product

(b) Production

(c) Advancement

(d) Transformation

(xi) Line of best fit is another name given to :

(a) Moving average method

(b) Method of Least Squares

(c) Trend Line method

(d) Straight line method

(xii) Independent float =

(a) Total float - Head Slack

(b) Earliest Start Time- Earliest Finish Time

(c) Free Float – Total Float

(d) None of the above.

(xiii) PERT is:

(a) Event oriented technique.

(b) Activity oriented technique.

(c) Both a & b

(d) None of the above.

(xiv) X Chart is used for :

(a) Cost control

(b) Quality control

(c) Programme control

(d) Job control

(xv) ABC Analysis is normally used in :

(a) SQC

(b) Production Control

(c) Value Analysis

(d) Inventory Control

Answer 3.

(i) (b) Value Analysis
(ii) (c) Product Mix
(iii) (b) Heat Treatment
(iv) (a) Time Study
(v) (c) Fluctuating load
(vi) (a) tools
(vii) (a) Material Requirement Planning
(viii) (c) Sequencing
(ix) (b) Human Engineering
(x) (b) Production
(xi) (b) Method of Least Squares
(xii) (b) Earliest Start Time-Earliest Finish Time
(xiii) (a) Event oriented technique
(xiv) (b) Quality control
(xv) (d) Inventory Control

Q. 4. (a) Name the general purpose machine tools which would produce the following :

(i) A 'U' –shaped groove on a Shaft –
(ii) Teeth on a gear wheel –
(iii) A flat face at end of a shaft –
(iv) Portion of a shaft top be supported in a bearing sleeve –
(v) A Flat surface on a large foundation block –

Answer 4. (a)

(i) Shaping Machine
(ii) Milling Machine
(iii) Lathe
(iv) Grinding Machine
(v) Planing Machine.

Q. 4. (b) What types of manufacturing processes are employed for the manufacture of :

(i) Porous metal filters –
(ii) Steel wire –
(iii) Hollow shaped castings –
(iv) Mild steel plates –
(v) Hook attached to a chain for lifting load –

Answer 4. (b)

(i) Powder metal filters
(i) Wire Drawing
(i) Centrifugal Casting
(i) Hot Rolling
(i) Drop forging

Q. 4. (c) State suitable Material Handling Equipments used in following operations :

(i) Iron scrap in a scrap yard –
(ii) Red hot steel billets in a rolling mill –
(iii) Charging iron ore in a blast furnace –
(iv) Move palletised unit loads –
(v) For movement of small components in a shop –

Answer 4. (c)

(i) Lifting magnet and crane
(ii) Roller Conveyor
(iii) Bucket Elevator
(iv) Fork-lift truck
(v) Hand Trolley

Q. 4. (d) 'Three' Limited is a popular manufacturer of different kind of lifting tools. These lifting tools are made of polypropylene fibre. The company installed a plant for backward integration of its raw material polypropylene fibre at the rate of 5000 mt per hour. The usage rate of these fibre for the production of lifting tool is 20000 mt per day considering 8 hours working per day. The cost of fibre is Rs. 5 per metre. The inventory carrying cost is 25% and the set up cost are Rs. 4050 per set up. Compute optimal number of cycle required in a year for manufacture of this special fibre. (Take 365 days as no. of days for year in your computations)

Answer 4. (d)

Production rate (p) = 5000 mt/hr.

Usage rate (r) = 20000/8 mt/hr = 2500 mt/hr.

Inventory carrying cost (Cc) = 25% of Rs. 5 = Rs. 1.25 /mt

Set up cost per setup (Co)= Rs.4050

Annual Requirement(R) = 20000 × 365 = 7300000 mt

$Q = \sqrt{2\,CoR/[(Cc/p)\times(p-r)]}$

$= \sqrt{2\times 4050\times 7300000/[1.25(5000-2500)/5000]}$

$= \sqrt{59130000000/.625} = 307584.13$

Optimal no. of cycles = R/Q = 7300000/307584.13 = 23.73 = 24 cycles.

Q. 5. (a) A crane wheel assembly is made of cast steel wheel and two gun metal bushes. Find the cost of the assembly assuming no special tooling is required and using the details given below :

	Cast Wheel	Gun Metal Bush
(i) Weight of each raw casting	**25 Kg.**	**3 Kg.**
(ii) Material Cost/Kg.	**20 Rs.**	**60Rs.**
(iii) Sale Price of Scrap/Kg.	**4 Rs.**	**40 Rs.**
(iv) Finished weight/unit after machining	**20 Kg.**	**2 Kg.**
(v) Machine hours required per unit :		
a. Boring M/c	**6 hrs.**	**—**
b. Lathe	**—**	**1.5 hrs.**

Machine Hour Rates are Rs. 40 /hour for Boring

Machine Hour Rates are Rs. 20/hour for Turning.

Assembly takes ½ Hr, costs Rs. 10/hour and consumes hardware worth Rs. 5/-.

Answer 5. (a)

Material Cost = (Cost of Raw Castings + Cost of Hardware) – (Scrap Sale)
= Rs. {(25 × 20) + (2 × 3 × 60) + 5} – {4 (25 – 20) + (2 × 40(3–2)}
= Rs. 765.

Machine Cost = {M/c Hr Rate × M/c Hr. required}
= {(40 × 6) + (2 × 20 × 1½)}
= Rs. 300.

Assembly Cost = Rs. (10 × ½) = Rs. 5.

Therefore, Total Cost = Material Cost + Machining Cost + Assembly Cost).
= Rs. (765 + 300 + 5) = Rs. 1070.

Q. 5. (b) A company is engaged in drilling and tapping of spark plugs for supply to an automobile company. The operations are performed on a CNC 3-Axis drilling and tapping center.

The CNC Cycle time is as follows :

Drilling time	**: 45 seconds**
Total tapping time	**: 1 minute 30 seconds.**
ATC tool changing time	**: 25 seconds.**

For feeding the spark plugs, the company designed a special fixture holding 10 plugs at a time and set up time by the operator for the 10 plugs is 1 minute 20 seconds.

The machine cycle time shown above includes the movement time of each spark plug also. The company has decided to augment capacity due to an additional order from an automobile co., to the extent of 1.10 lakhs' spark plugs per year. Assuming that manpower is no constraint, how many additional drilling tapping centers the company should procure under the Augmentation Plan? Average rejections % is 2 % of the produced spark plugs in drilling-tapping centers.

Assume 300 working days/year of 8 hrs. per day. Please note that 20% time, the drilling and tapping centers are not available due to preventive maintenance and the utilization is 70% of the available time due to power and service line shut downs.

Answer 5. (b)

CNC Cycle time= 45 secs +90 secs +25 secs = 160 seconds.

Set up time for 10 spark plugs = 1 min. 20 secs = 80 seconds.

Total production time for 10 spark plugs = 160 × 10 + 80 = 1680 seconds.

Production time per spark plug per drilling-tapping center = 1680/10 = 168 seconds.

Available machine hours per center per year = 300 days × 8 hrs./day × 0.80 = 1920

Utilized machine hrs. per year per center = Available m/c hrs. × shop efficiency = 1920 × 0.7 = 1344 hours.

Therefore 1 drill-tapping center can produce in a year
= 1344 × 60 × 60/168 spark plugs.
= 28,800 nos.

Since the additional order is 1.1 lakhs spark-plugs of accepted quality (after 2% rejection), no. of drill-tapping centre to be procured = 110000/0.98 × 28 800
= 3.89 i.e., 4 nos.

Q. 5. (c) Distinguish between a flow shop and a job shop.

Answer 5. (c)

Flow Shop	Job Shop
(i) In a flow shop, continuous production/ assembly line, each of the *n* jobs must be processed through m machines in exactly the same order and once in every machine.	(i) In a job shop, not all n jobs are assumed tom pass through or require processing in m machines. Also some jobs may require more than one operation in the same machine. The sequencing of operations, may be different for different jobs.
(ii) Specialised machine results in low variable cost per unit and high volume absorbs the fixed cost easily ; so unit cost is low.	(ii) Wide variety at reasonably low cost since general purpose machines are utilized.
(iii) Even unskilled or semi-skilled operator will be able to operate the machine thereby reducing dependencies on workers.	(iii) Through grouping of facility around standard operations, high capacity utilization could be effected.
(iv) Operation management is much simpler and meeting delivery commitments is relatively easier.	(iv) The workers are engaged in non-repetitive and challenging job. Their job gets enriched and morale high.
(v) Failure at any stage would result in breakdown of entire flow until repair is completed.	(v) Determination of optimum batch size creates a problem.
(vi) The pace of production is determined by the slowest machine.	(vi) Material flow is complicated and unsystematic.
(vii) The system is relatively inflexible.	(vii) Machines are diverse and operations are complex requiring highly skilled workers.
(viii) The system requires high investment due to specialized nature of machine.	(viii) Material Handling cost is usually higher since flow lines are irregular.

Q. 6. (a) COORAN, a limited company, planning to manufacture a household cooking range has to decide on the location of the plant. Three locations are being considered viz, Patna, Ranchi and Dhanbad. The fixed costs of the three locations are estimated to be Rs. 30 lakhs, 50 lakhs and 25 lakhs per annum respectively. The variable costs are Rs. 300, Rs. 200 and Rs. 350 per unit respectively. The expected sales price of the cooking range is Rs. 700 per unit.

Find out :

(i) the range of annual production/sales volume for which each location is the most suitable;

(ii) which one of three locations is the best location at a production/sales volume· of 18000 units?

Answer 6. (a)

The total cost of three locations are :

Total cost = Fixed cost + Variable cost for a volume "X"

Patna = Total cost = 30,00,000 + 300 "X"

Ranchi = Total cost = 50,00,000 + 200 "X"

Dhanbad = Total cost = 25,00,000 + 350 "X"

Now computing and plotting the total costs per annum at three di fferent locations for the various cases of production volume of 5000, 10000, 15000, 20000, 25000 units.

(a) Patna

Volume (units)	5000	10000	15000	20000	25000
Total costs (Rs/lakhs.) =	3000000+ 300(5000) = 45 lakhs	3000000+ 300(10000) = 60 lakhs	3000000+ 300(15000) = 75 lakhs	3000000+ 300(20000) = 90 lakhs	3000000+ 300(25000) = 105 lakhs

(b) Ranchi

Volume (units)	5000	10000	15000	20000	25000
Total costs (Rs/lakhs.) =	5000000+ 200(5000) = 60 lakhs	5000000+ 200(10000) = 70 lakhs	5000000+ 200(15000) = 80 lakhs	5000000+ 200(20000) = 90 lakhs	5000000+ 200(25000) = 100 lakhs

(c) Dhanbad

Volume (units)	5000	10000	15000	20000	25000
Total costs (Rs/lakhs.) =	2500000+ 350(5000) = 42.5 lakhs	2500000+ 350(10000) = 60 lakhs	2500000+ 350(15000) = 77.5 lakhs	2500000+ 350(20000) = 95 lakhs	2500000+ 350(25000) = 112.5 lakhs

If the volume distributions are as follows :

Volume of production	**Upto 10000 units**	**Between 10000 units to 20000 units**	**Above 20000 units**
Favourable Location	Dhanbad	Patna	Ranchi

For a volume 18000 units favourable location is Patna, which can be substantiated by the followings :

Patna = 3000000 + 300 × 18000 = Rs. 84 lakhs.

Ranchi = 5000000 + 200 × 18000 = Rs. 86 lakhs.

Dhanbad = 2500000 + 350 × 18000 = Rs. 88 lakhs.

Q. 6. (b) Should the following industries 'Simplify' or ' Diversify' and why?

(I) Automobile (II) Cosmetic

Answer 6. (b)

(I) **Automobile manufacturer** should follow simplification for the following reasons :

(i) Since many parts and processes are involved , simplification reduces production control problems.

(ii) Simplification would enable use of special purpose machines with permanently installed special purpose tooling ,since high precision jobs are involved.

(iii) Semi skilled workforce can be employed in place of highly skilled , thus reducing labour costs;

(iv) Since a variety of raw materials/ components inventory is needed , simplification would help in reducing inventory.

(II) **Cosmetics manufacturer** should follow diversification for the following reasons:

(i) Seasonal fluctuations in demand for different types of cosmetics can be met.

(ii) Risk of loss due to certain products is minimized.

(iii) Provides better customer service by offering a wide choice of items in this high fashion industry

(iv) Overhead Costs are spread over a larger sales volume , thus reducing overall costs

Q. 6. (c) What are the fundamental principles of material handling system? Briefly state their salient features.

Answer 6. (c)

The following are the some of the fundamental principles of material handling system :

(i) No handling is best handling : Since material handling is only a cost and does not add to the quality or value of product, its handling cost should be kept to its barest minimum.

(ii) Principle of gravity feed : Wherever possible , flow line and gravity should be used to move materials.

(iii) Principle of flexibility : The handling system should be fully flexible, so as to accommodate changes in products, plant layout, volume of output etc.

(iv) Principle of flow of materials : Continuous and straight line movement is more efficient than irregular movement.

(v) Principle of safety and satisfaction : The system should be safe and offer satisfaction.

(vi) Principle of standardization : Standardization of method, types of equipment and sizes of equipment is desirable for increasing efficiency of material handling.

(vii) The 'size of load' principle : There is an ideal load size in a given material handling operation.

(viii) The handling equipment should be simple and consistent with nature of materials and speed of movement. Where ever possible the handling should be combined with production equipment.

(ix) Fixed routes should be established for all handling devices and there should be no back tracking in the system.

Q. 7. (a) What do you understand by the term 'Utilities' in a factory? Briefly describe the different 'Utilities' required in a factory.

Answer 7. (a)

Utilities comprise of the auxiliary and support facilities required to operate the main production facilities. These are very crucial, especially, in a process plant. Sometimes, in continuous chemical processing plants, utilities like de-mineralized water and steam become process inputs. In steel making, oxygen is an input. Compressed air plays a key role in instrumentation and conveying of materials.

Some common 'Utilities' are :

(i) **Water :** This is a very important utility and refers to water storage, water treatment, steam generation, other industrial uses including potable water-cooling water, water for fire fighting/irrigation of landscapes, etc., This is a scarce resource and recycling is important. Role of water is very crucial in some chemical, metallurgical and power plants and in such cases water alone determines the survival of the plant.

(ii) **Compressed Air :** A bunch of compressors is installed for producing compressed air used in instruments and for pneumatic conveying equipment.

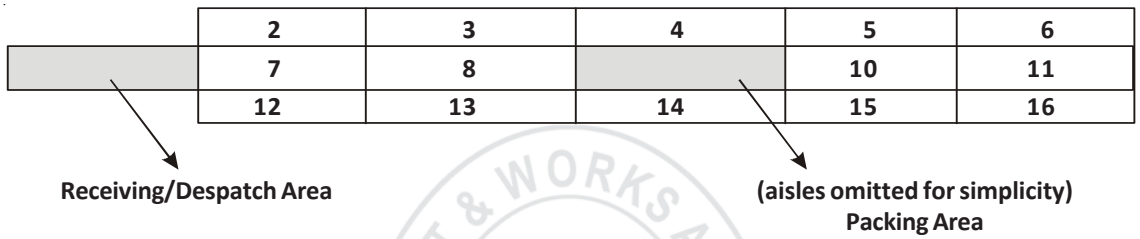
(iii) **Steam :** Process Steam is generated through suitable boilers depending on pressure, temperature and quantity of steam required. Process steam is normally used for heating process vessels, etc.,

(iv) **Captive Power :** is an important utility and its role is likely to increase in future, with the advent of power sector reforms in the country and with no improvements in sight in the existing power scenario. Conventional choices are thermal power, diesel gensets and gas turbines. Non-conventional sources growing in popularity in the recent times are solar energy systems, windmills, etc.,

(v) **Effluent Treatment :** With stringent environmental regulations and increasing public .awareness, air, water and solid waste pollutants have to be monitored, controlled and kept within the statutory limits.

(vi) **Others :** There are a number of other utilities required in a manufacturing organization like Heating, Ventilation, A/C and Refrigeration Plants, Humidification Systems, Oxygen Plants, Chemical Recovery Systems, Fire Protection, Communication Systems, etc.,

Q. 7. (b) The existing layout of a Finished Goods Stores in a manufacturing organization is as follows :



The other areas (2 to 8 and 10 to 16) are storage areas for differednt products.

Material flows between Area 9 and other 15 sec tions/areas. Loads are moved to Area 1 only from Area 9. All other loads flow from remaining areas/sections into Area 9. For simplicity, we consider only loads moved to Packing Area 9 from all areas, except the Receiving/Despatch Area 1. The location of Receiving/Despatch Area 1 is fixed and cannot be relocated. All other areas can be considered for relocation.

Average annual loads from each area/section to Area 9 are follows :

Area	Load	Area	Load	Area	Load	Area	Load	Area	Load
2	500	5	150	8	350	12	150	15	250
3	100	6	150	10	250	13	250	16	500
4	350	7	150	11	100	14	100		

From Area 9 to Area 1, average annual loads are 2800. Using the Load Distance Matrix, arrive at an improved layout.

Answer 7. (b)

Load-Distance Matrix of the Present Layout :

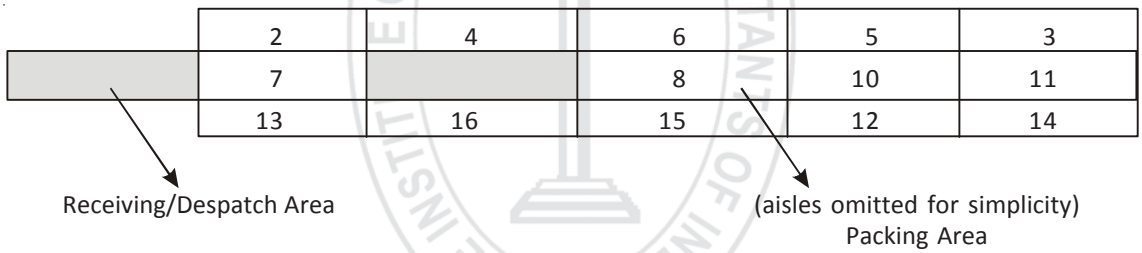
Work Centre Pair (i, j)	Distance D ij between i & j	Load L ij between i & J	Load-Distance Rating L ij D ij	Total
Adjacent Work Centre :				
3, 9	1	100	100 × 1 = 100	
4, 9	1	350	350 × 1 = 350	
5, 9	1	150	150 × 1 = 150	
8, 9	1	350	350 × 1 = 350	
10, 9	1	250	250 × 1 = 250	
13, 9	1	250	250 × 1 = 250	
14, 9	1	100	100 × 1 = 100	
15, 9	1	250	250 × 1 = 250	1,800

Work Centre Pair (i, j)	Distance D ij between i & j	Load L ij between i & J	Load-Distance Rating L ij D ij	Total
Adjacent Work Centre :				
2, 9	2	500	500 × 2 = 1000	
7, 9	2	150	150 × 2 = 300	
12, 9	2	150	150 × 2 = 300	
6, 9	2	150	150 × 2 = 300	
11, 9	2	100	100 × 2 = 200	
16, 9	2	500	500 × 2 = 1000	
9, 1	3	2800	2800 × 3 = 8400	11,500
Total Load-Distance Rating				13,300

Improvements Proposed : Move areas with heavy load-flows between them closer.

Eg., Packing Area can be moved closer to Despatch Section, Area 16 can be moved closer to Packing Area and Area 14 farther away.

After incorporating these and other changes, the revised layout will look as:



Revised Load-distance Matrix of the Present Layout :

Work Centre Pair (i, j)	Distance D ij between i & j	Load L ij between i & J	Load-Distance Rating L ij D ij	Total
Adjacent Work Centre :				
2, 9	1	500	500 × 1 = 500	
4, 9	1	350	350 × 1 = 350	
6, 9	1	150	150 × 1 = 150	
7, 9	1	150	150 × 1 = 150	
8, 9	1	350	350 × 1 = 350	
13, 9	1	250	250 × 1 = 250	
15, 9	1	250	250 × 1 = 250	
16, 9	1	500	500 × 1 = 500	2,500

Work Centre Pair (i, j)	Distance D ij between i & j	Load L ij between i & J	Load-Distance Rating L ij D ij	Total
Adjacent Work Centre :				
3, 9	3	100	100 × 3 = 300	
5, 9	2	150	150 × 2 = 300	
10, 9	2	250	250 × 2 = 500	
11, 9	3	100	100 × 3 = 300	
12, 9	2	150	150 × 2 = 300	
14, 9	3	100	100 × 3 = 300	
9, 1	2	2800	2800 × 2 = 5600	7,600
Total Load-Distance Rating				10,100

Thus, there is a reduction in the Load-Distance Rating of (13,300 – 10,100) = 3,200 over 13,300.
Therefore, % Improvement = (3,200/13,300) × 100 = 24.06% say 24%.

Q. 8. (a) A manufacturing organization operates an incentive scheme on slab rates based on cost of production as shown below :

Saving in production cost (Labour + Material + Overheads)	Incentive Amount (as % of savings)
1 - 10%	**5%**
11 - 20%	**15%**
21 - 40%	**30%**
41 - 70%	**40%**
Above 70%	**50%**

Three workers X, Y, and Z take 25 hours, 30 hours and 15 hours respectively to produce 10 units of the product and their respective wage rates are Rs. 6/-, Rs. 6.50/- and Rs. 7/- per hour. The material costs Rs. 50/- per unit and the overhead recovery rate is @ 500 % of cost of wages. The standard cost of production per unit is determined as Rs. 175/- per unit.

What is the amount of incentive earned by each of these workers and what is the actual cost of production per unit in each case?

Answer 8. (a)

		PRODUCT		
		X	Y	Z
i.	Production in Units	10	10	10
ii.	Wage Rate (Rs/Hr)	6.00	6.50	7.00
iii.	Time taken for Production (Hrs).	25	30	15
iv.	Wages Earned (Rs)	150	195	105
v.	Overheads(500% of wages) (Rs.)	750	975	525
vi.	Materials (@ Rs.50/ per unit)	500	500	500
vii.	TOTAL COST OF PRODUCTION (Rs)	1400	1670	1130
viii.	Standard cost of Production (Rs.)	1750	1750	1750

		PRODUCT		
		X	**Y**	**Z**
ix.	Savings in cost ofproduction (Rs.)	350	80	620
x.	% Savings in Production Cost (Rs.) (ix ÷ viii) x 100	20	4.57	35.43
xi.	Incentive Slab	15%	5%	30%
xii.	Incentive Amount (Rs.) (xi × ix)/100	52.50	4.00	186.00
xiii.	ACTUAL COST OF PRODUCTION (Rs.) (vii+xii)	1452.50	1674.00	1316.00
xiv.	ACTUAL COST OF PRODUCTION /UNIT (Rs.) (SL-xiii ÷ 10 units)	145.25	167.40	131.60

Q. 8. (b) An automobile ancillary unit manufactures and supplies three types ofradiator brass caps A, Band C to an automobile manufacturer. During the year 2009-10 the unit produced 30,000; 45,000 and 30,000 of A,B and C respectively. Units 5MB of A,B and C are 3,4 and 4.5 respectively. The ,unit engaged 300 Industrial employees during the year and the ratio of Direct Labour to Indirect Labour to was 1 :0.5. The unit worked 8 hrs shift per day for 6 working days in a week and there were 50 weeks working during the year. Assuming on an average 10% absenteeism among employees. What was the productivity *of* direct labour during the year?

Answer 8. (b)

Total SMH ouput during the year 2009-10

= 3 × 30,000 + 4 × 45,000 + 4.5 × 30,000

= 4,05,000 (Product A,B and C).

Total MH input during 2009-10

= 300 (Industrial Employees shifts) × 1/1.5) × 8 Hr's/day × 6 days/week × 50 weeks × 0.9 (attendance)

= 4,32,000

Therefore Direct Labour Productivity = (SMH output/Input MHrs).

= 405,000/432,000

= 0.938 i.e., 93.8%.

Q. 8. (c) "Any increase in Productivity has to come through concerted efforts of all parties." — Explain, in this respect, the role of :

(i) Workers

(ii) Trade unions

(iii) Management and

(iv) Government

Answer 8. (c)

Any increase in productivity has to come through concerted efforts of all the concerned parties like workers, Trade Unions, Management and the Government. Role played by each of these palties wi II be very crucial and important.

(i) **Role of workers :** Workers should understand clearly that their progress and prosperity will depend on the growth & prosperity of the company. Workers should be committed to take the organization forward through their dedicated and devoted work.

(ii) **Role of Trade Unions :** Under the present day Industrial scenario, Trade Unions have a very vital positive role to play in increasing productivity by maintaining a peaceful Industrial Relations with the Management. They should understand that strikes &work stoppages are basic deterrent factors for productivity and should be resorted to only during . S.O.S.

(iii) **Role of Management :** Managenient should adopt a 'Win-Win' and a 'Give & Take' policy, while solving workers' problems. They should regard their Human Resource as their most important and valuable assets.

(iv) **Role of Government :** The policies of the Government will have a large bearing on the Corporate Productivity. Government should try to curb 'inflationary trend', offer fiscal concessions, reduce corporate tax, adopt rational tariff rates in excise; commercial taxes and other devices.

Q. 9. (a) The following tasks are to be performed on an assembly line in the sequence and times specified :

Task	Time (Seconds)	Tasks that must precede
A	50	–
B	40	–
C	20	A
D	45	C
E	20	C
F	25	D
G	10	E
H	35	B, F, G

(i) Draw the schematic diagram.

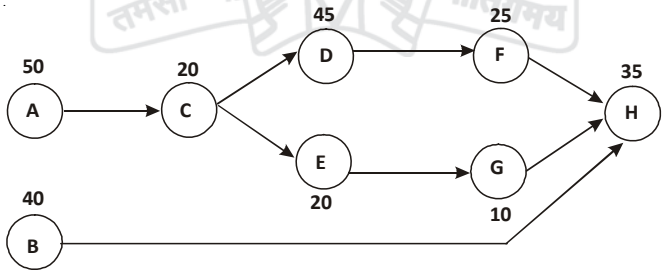
(ii) What is the theoritical minimum number of stations required to meet a forecasted demand of 400 units per an 8-hour day?

(iii) Use the longest task time rule and balance the line in the minimum number of stations to produce 400 units per day.

(iv) Evaluate the Line Efficiency and the Smoothness Index

Answer 9. (a)

(i) **Schematic Diagram :**



(Activity on Node)

(ii) Theoretical minimum number of stations to meet D = 400 is :

$$N = T/C = \frac{245}{\{(60\ \text{seconds} \times 480\ \text{minutes}) \div 400\ \text{units}\}}$$

$$= 245 \div 72$$

$$= 3.4 \text{ day } 4.$$

(iii) Line Balancing :

Station	Task	Task Time (Seconds)	Unassigned Time (Seconds)	Feasible Remaining Task	Station Time (Seconds)	Cycle time (Seconds)
1	A	50	22	C	70	70
	C	20	2	None		
2	D	45	27	E, F	70	70
	F	25	2	None		
3	B	40	32	E		
	E	20	12	G	70	70
	G	10	2	None		
4	H	35	37	None	35	70
Total					245	280

(iv) Line Efficiency = (245/280) × 100 = 87.5%

Smoothness Index = $\sqrt{(70-70)^2+(70-70)^2+(70-70)^2+(70-35)^2}$

= $\sqrt{(35)^2}$ = 35%.

Q. 9. (b) Manufacture of a component requires operations to be performed on three machines A, B and C respectively. The standard times, operator efficiencies and machine availabilities of each of the machines are as follows :

Machine	Operator Efficiency	Std. Man-Hrs per component	Machine availability
A	**80%**	**0.20**	**100%**
B	**100%**	**0.25**	**80%**
C	**90%**	**0.15**	**75%**

(i) If the factory operates in 2 shifts of 8 hours each for 6 days in a week, how many each of machines A, B, and C will be required to produce 4800 components per week?

(ii) What is the spare capacity available on each of the machines?

Answer 9. (b)

Available Hours in 2 shifts of 8 hours each for a 6 day working week for:

Machine A :	6 x 2 x 8 x 100 % =	96 Hrs.
Machine B :	6 x 2 x 8 x 80 % =	76.8 Hrs.
Machine C :	6 x 2 x 8 x 75 % =	72 Hrs.

Actual Hours required on each machine:

= Standard hours per component x production quantity/operator's efficiency:

Machine A:	(0.20 x 4800)/ 0.80 =	1200 Hrs.
Machine B :	(0.25 x 4800)/1.00. =	1200 Hrs.
Machine C :	(0.15 x 4800) / 0.90 =	800 Hrs.

No. of M/cs required :

= Actual hours required : Available hours per machine.

Machine A :	1200/96	= 12.5	say 13.
Machine B :	1200/76.8	= 15.625	say 16.
Machine C :	800/72	= 11.11	say 12.

Spare capacity on each of the machines per week :

Machine A :	0.5 x96	=	48 Hrs.
Machine B :	0.375 x 76.8	=	28.8 Hrs.
Machine C :	0.89 x 72	=	64.1 Hrs.

Q. 9. (c) What factors might cause a company to order an amount larger or smaller than Economic Order Quantity?

Answer 9. (c)

It is always desirable to be strict to EOQ model. But it is to be kept in mind that EOQ model is useful under condition of certainty. Under real life situation, it is rarely so. Possible reasons for violation of EOQ model may be :

(i) The demand pattern of inventory and lead time is not certain.

(ii) Most of the firm maintain some amount of margin of safety or safety stock to cater to the contingent situation. These are based on own assumption. Hence actual quantity may vary from man to man.

(iii) The amount arrived at through EOQ computation may not be available or may not be accepted by the transporters.

(iv) Mismatch between transportation cost and EOQ associated cost.

(v) Panicky buying tendency of the person engaged.

(vi) Firm may be inclined to take advantage of impeding price hike by the suppliers and /or discount offered. Holding gain in inventory may also be important.

Q. 10. Write short note on :

(a) Supply Chain Management

(b) Activity Sampling

(c) Job Enrichment

(d) Route Card

Answer 10. (a)

Supply Chain Management : The term 'supply chain' comes from a picture of how organizations are linked together. If we start with purchase department and work down on the supply side, we find a number of suppliers , each of whom in turn has its own supplier. This can indeed be a complex network or a series of chains.

The objectives of supply chain management are reduction of uncertainty and risk in the supply chain which will enable reduction in inventory levels, cycle time of processing and ultimately improve end-customer service levels. The focus is on system optimization. Some of the useful tools are forecasting, aggregate planning, inventory management, scheduling etc.

The forecast becomes an input to the aggregate plan, which sets the guidelines and constraints for development of an inventory system from which the detailed workforce and equipment schedules can be determined. The decisions made in one node of the supply-chain affect the other areas, e.g if an automobile

industry factory plans to assemble 1000 vehicles in a given period, it is imperative that the supplier of tyres makes available 4000 tyres at the plant in time for use on the assembly line.

The overall plan needs to be optimized so that adequate number of men, materials and time available to meet the requirements.

Answer 10. (b)

Activity Sampling : The technique by which a large number of instantaneous observations are made over a period of time of a group of workmen, processes or machines is known as 'Activity Sampling' or 'Work Sampling'.

Each observation records what is happening at that instant and percentage of observations recorded for a particular activity or delay is a measure of percentage of time during which that activity or delay occurs.

The main uses of Activity Sampling are :

(i) Measurement of activities or delay

(ii) Measurement of manual tasks and establishment of time standards under certain circumstances.

Answer 10. (c)

Job Enrichment : It is monotonous to repeat the same tasks day after day throughout the working life of an employee. If there is no variety and change, the employee gets detached and frustrated. Job enrichment is a way of improving the job by adding more meaningful and skillful tasks from time to time to the existing tasks, thus making the job more satisfying to the employee. This will also make people multi-skilled and enhance the versatility of the employee, e.g. production workers may be asked to perform simple and routine maintenance activities or quality control activities.

Answer 10. (d)

Route card : A Route card is written statement indicating the route a component has to follow in sequence to ensure quality requirements as specified in the design.

The Route Card contains the following :

(i) The operation required and specified sequence of these operations:

(ii) The Machines or Equipments to be used; and

(iii) The estimated set-up time and runtime per piece.

For preparation of shop schedules, route sheet of all the components to be processed are used as master document. Route Card also act travelling instruction sheets to inform the foreman and workers when and where to deliver the components for next operation and or inspection. Route Cards are prepared by Process Planning Engineers after due consideration of the capabilities and capacities of various machines, equipment and process. A lot of engineering inputs is required to prepare the Route Card as it becomes the ultimate reference document for processing a component of desired accuracy and quality.

Q. 11. (a) Explain the term 'cost of quality'.

Answer 11. (a)

The maintenance of quality involves certain expenditure and costs. These are known as Costs of Quality and they comprise of the following :

(i) Higher cost due to use of better quality of materials.

(ii) Use of more expensive machines of advanced designs.

(iii) Deployment of highly skilled workers , there by increasing total costs.

(iv) Heavy rejections and attendant reworking.

(v) Costs of disposal of scrap and wastes.

The costs mentioned above gets added to the product cost and hence high quality becomes more expensive, generally. Thus cheaper products may not be able to afford the luxury of Costs of Quality.

Q. 11. (b) Distinguish between Specification and Tolerance.

Answer 11. (b)

Specification	Tolerance.
These normally comprise length, breadth, thickness, diameter, height etc. and are essential for any manufactured product. These are mentioned normally on the drawings for manufactured products and in purchase orders for bought out items.	Tolerance is the range within which deviations from specifications are acceptable. In certain case, tolerances are specified on either side, i.e the deviation can be on the lower side and higher side of the specification. In case of certain other specifications, they can on one side only, viz, either on higher side or lower side, but not on both sides. Gross tolerance is the maximum tolerance permissible for a given class of fit.

Q. 11. (c) What are the objectives of using Control Charts for Variables?

Answer 11. (c)

The objectives of using Control Chart for Variables are as follows :

(i) To monitor a production process on a continuing basis.

(ii) To analyze the process with a view to establishing or changing specifications/production, procedures/inspection and/or procedures.

(iii) To provide a basis for continuous evaluation of production as to when to look for causes for external variations and to take action with a view to correct a process and when to leave a process alone.

(iv) To provide a basis for correct decisions on acceptance or rejection of manufactured or purchased product.

Q. 11. (d) 20 samples were obtained from the fabric being produced by a weaving machine. The number of defects per 100 metres of cloth for the samples is given below :

15 13 14 12 17 14 13 16 16 15

12 13 13 12 15 14 14 17 16 15

(i) Determine the Control Chart limits for the machine;

(ii) On a particular day, when the machine is operating under controlled conditions, 10 samples were drawn and the defects per 100 metres of cloth are as follows :

11 18 27 12 13 8 2 15 19 20

What conclusions would you draw from these observations?

Answer 11. (d)

(i) If $\bar{C}$ is the mean ("c" being the individual observation) and "n" the number of observations,

We have $\bar{C} = \Sigma c/n$.

Control Limits for the number of defects per 100 metres are : $\bar{C} \pm 3\sqrt{\bar{C}}$

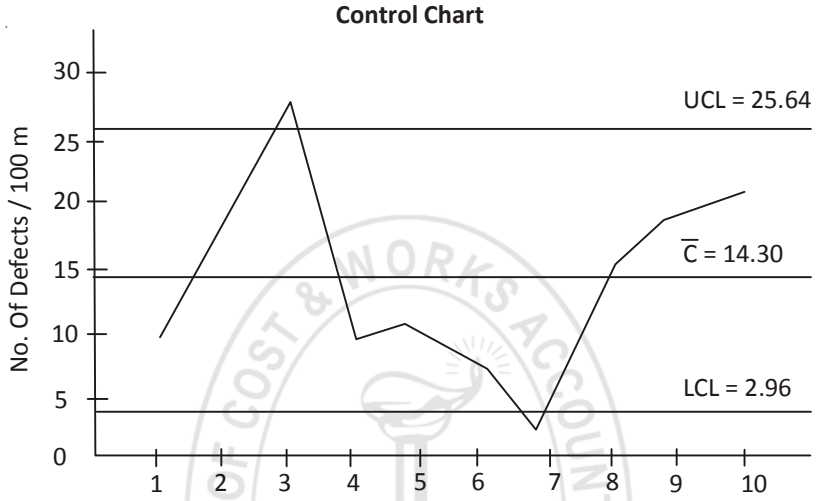
Σ C for the given observations = 286

$\therefore \bar{C} = \frac{286}{20} = 14.3$

Upper Control Limit (UCL) = $14.3 + 3\sqrt{14.3} = 14.3 + (3 \times 3.78) = 25.64$

Lower Control Limit (LCL) = $14.3 - 3\sqrt{14.3} = 14.3-(3 \times 3.78) = 2.96$

(ii) The Control Chart with plots of the defectives of the 10 samples looks as follows :



The following observations can be made from the plot above :

(i) Reasons for Sample NO.3 to have defects abnormally higher than UCL must be found out;

(ii) Reasons for Sample NO.7 with defects lower than LCL must also be found out.

Note :

In case of (i) above, the machine was behaving badly, while in case of (ii) above, the machine was operating extremely nicely. The process conditions at both the times should be studied in detail and it must be explored whether conditions prevailing when Sample NO.7 was withdrawn can be perpetuated.

(iii) There seems to be a cyclical pattern in the number of defects alternately going up and down. The reasons must be explored. However, a larger sample may be drawn to confirm the cyclical pattern.

Q. 12. Competent Automobile is an authorised service centre of Maruti Cars. A new manager employed wants to analyse the efficiency of work and service personnel. To facilitate his analysis, he has classified the service procedure into the following seven activities :

Activity	*Duration (Hrs.)*	*Precedence Activity*
A	**8**	**—**
B	**4**	**—**
C	**6**	**A**
D	**9**	**B**
E	**11**	**A**
F	**3**	**C**
G	**1**	**D, E, F.**

Help him by-

(a) Drawing the network diagram.

(b) Finding the critical path.

(c) Calculating the expected time for service of a car.

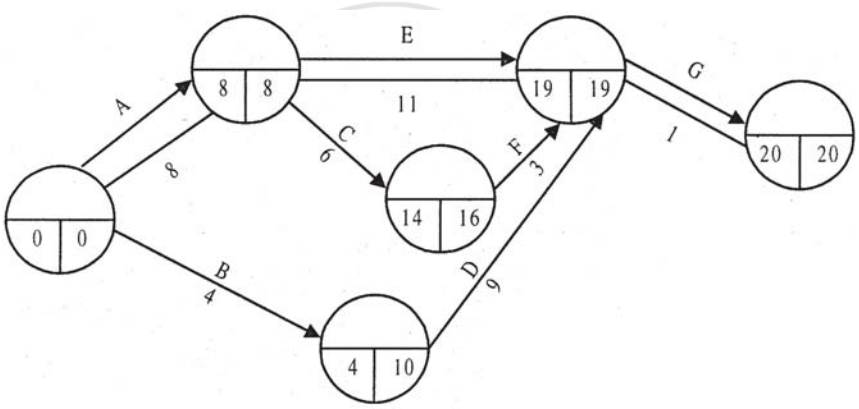
(d) Amount of slack time for the technician in each activity.

(e) Computing the Earliest Starting and Finishing Time.

(f) Computing the Latest Finishing and Starting Time.

Answer 12.

(a)



(b) Critical Path: A-E-G

(c) Expected time for service of a car : 20 hrs.

(d) Slack time for the technician in each of the 3 paths are :

ACFG : 2 Hrs.

AEG : 0 Hr.

BDG : 6 Hrs.

(e) & (f)

Activity	Duration	ES	EF	LF	LS
A	8	0	8	8	0
B	4	0	4	10	6
C	6	8	14	16	10
D	9	4	13	19	10
E	11	8	19	19	8
F	3	14	17	19	16
G	1	19	20	20	19
(ES, EF, LF, LS)					

Q. 13. Vision Graphics provides copy services for law firms in Mumbai suburbs.

Five customers submitted their orders at the beginning of the week. Specific scheduling data are as follows :

Job (in order of arrival)	Processing Time (days)	Due date (days hence)
A	3	5
B	4	6
C	2	7
D	6	9
E	1	2

(i) FCFS (First Come First Served)

(ii) SOT (Shortest Operation Time)

(iii) D Date (Due Date)

(iv) STR (Slack Time Remaining)

(v) LCFS (Last Come First Served)

Compute the Mean Flow Time and Average Lateness using the Five Priority Rules and determine the best Priority Rule to sequence the jobs.

Answer 13.

The Job Sequencing and the associated computations under each Priority Rule are shown in the following tables :

FCFS Schedule

Job Sequence (1)	Processing Time (Days) (2)	Due Date (Days Hence) (3)	Flow Time (Days) (4)	Days Late (5) = (4) (3)
A	3	5	0+3 = 3	0
B	4	6	3+4= 7	1
C	2	7	7+2=9	2
D	6	9	9+6=15	6
E	1	2	15+ 1 = 16	14
Total			50	23

(i) Mean Flow time = 50/5 = 10.0 days.

(ii) Average Lateness = 23/5 = 4.6 days.

SOT Schedule :

Job Sequence (1)	Processing Time (Days) (2)	Due Date (Days Hence) (3)	Flow Time (Days) (4)	Days Late (5) = (4) (3)
E	1	2	0+1 = 1	0
C	2	7	1+2 = 3	0
A	3	5	3+3 = 6	1
B	4	6	6+4 = 10	4
D	6	9	10+6 = 16	7
Total			36	12

(i) Mean Flow time = 36/5 = 7.2 days.

(ii) Average Lateness = 12/5 = 2.4 days.

D Date Schedule

Job Sequence (1)	Processing Time (Days) (2)	Due Date (Days Hence) (3)	Flow Time (Days) (4)	Days Late (5) = (4) (3)
E	1	2	0+1 = 1	0
A	3	5	1+3 = 4	0
B	4	6	4+4 = 8	2
C	2	7	8+2 = 10	3
D	6	9	10+6 = 16	7
Total			39	12

(i) Mean Flow time = 39/5 = 7.8 days.

(ii) Average Lateness = 12/5 = 2.4 days.

STR Schedule

Job Sequence (1)	Processing Time (Days) (2)	Due Date (Days Hence) (3)	Flow Time (Days) (4)	Days Late (5) = (4) (3)
E	1	2	0+1 = 1	0
A	3	5	1+3 = 4	0
B	4	6	4+4 = 8	2
D	6	9	8+6 = 14	5
C	2	7	14+2 = 16	9
Total			43	16

(i) Mean Flow time = 43/5 = 8.6 days.

(ii) Average Lateness = 16/5 = 3.2 days.

Note : (–)ve values obtained in column (5) are treated as '0' (no delay).

LCFS Schedule

Job Sequence (1)	Processing Time (Days) (2)	Due Date (Days Hence) (3)	Flow Time (Days) (4)	Days Late (5) = (4) (3)
E	1	2	0+1 = 1	0
D	6	9	1+6 = 7	0
C	2	7	7+2 = 9	2
B	4	6	9+4 = 13	7
A	3	5	13+3 = 16	11
Total			46	20

(i) Mean Flow time = 46/5 = 9.2 days.

(ii) Average Lateness = 20/5 = 4.0 days.

Conclusion : SOT is the most perferred Priority Rule for the Job Sequencing as this schedule has the lowest Mean Flow Time of 7.2 days of all the schedules considered.

Q. 14. (a) What are the measures commonly adopted to assess the effectivity of maintenance department? Which measure would you like to adopt in case of maintenance of CNC machines when there is surplus capacity but parts/components are very costly in nature?

Answer 14. (a)

Measures commonly adopted to assess the effectivity of the maintenance department are:

(i) **Downtime analysis:** This is measured as -

(I) Downtime/Available Hrs. × 100

(II) Downtime due to scheduled maintenance/ Downtime due to total maintenance work.

(ii) **Reliability and failure pattern analysis :** This analysis is done through Mean Time Between Failure (MTBF) concept.

(iii) **Repair time:** Time taken to repair and restore the machine.

(iv) Analysis of inspections due - Inspections complete/Inspections scheduled × 100. The figure should be less than 10%

In case of maintenance of CNC machines, when there is surplus capacity but the parts/components are very costly nature, the measure of MTBF would be most ideal to adopt, since any breakdown is likely to cause damage to the jobs and as well may lead to rejections.

Q. 14. (b) A workshop has 20 identical machines whose failure pattern is as below :

Elapsed time (months)	No. of machines failed
1	**4**
2	**3**
3	**3**
4	**3**
5	**3**
6	**4**

It cost Rs. 150 to attend to a broken-down machine. A maintenance contractor offers preventive maintenance of the machines and in return guarantees no failure of the machine for one year. He charges Rs. 450 per machine per year. Would you go for preventive maintenance contract?

Answer 14. (b)

The cost of preventive maintenance is Rs. 450×20 = Rs. 9000 per annum

From the data given

Expected time before failure = (4/20)×1 + (3/20)×2+(3/20)×3+(3×20)×4+(3/20)×5+(4/20)×6 = 3.5 months

Nos. of repair per machine per annum = 12/3.5

Considering 20 machines and Rs. 150 to attend a failed machine, the yearly

Cost of servicing = (12/3.5) × 20 × 150 = Rs. 10,286

Preventive maintenance, which is only Rs. 9000 per year would be cheaper, as compared to breakdown maintenance cost which is Rs. 10,286.

Q. 14. (c) The following mortality rates have been observed for a certain type of light bulbs.

Week	Present failing by week end
1	10
2	25
3	50
4	80
5	100

There are 1000 bulbs in use and it cost Rs. 20 to replace an individual bulb which has burnt out. If all bulbs are replaced simultaneously, it would cost Rs. 4 per bulb. It is proposed to replace all the bulbs at fixed intervals , whether or not they are burnt out, and to continue replacing burnt out bulbs as they fail. At what levels the bulbs should be replaced to optimise.

Answer 14. (c)

Week	Percentage failure by week end.	Probability of failure
1	10	0.10
2	25	0.15
3	50	0.25
4	80	0.30
5	100	0.20
		1.00

Week	Probability of failure	No. of bulbs failing	Cost of replace-ment @ Rs. 20/wk	Cost of group replace-ment @ Rs. 4	Total cost group replace-ment	Average Cost.
1	0.10	100	2000	4000	6000	6000
2	0.15	100*0.1+1000*0.15=160	3200	4000	9200	4600
3	0.25	100*0.15+160*0.1+1000*0.25=281	5620	4000	14820 (9200+ 5620)	4940
4	0.30	100*0.25+160*0.15+281*0.10+ 1000*0.30=25+24+28+300 = 377(approx)	7540	4000	22360 (14820+ 7540	5590
5	0.20	100*0.30+160*0.25+281*0.15+ 377*0.10+1000*0.20=350(approx)	7000	4000	29360 (22360+ 7000)	5872

Cost is minimum when replacement is made in every two weeks. So replacement every two weeks is recommended.

Q. 15. (a) (i) What is Delphi technique? What is its applicability in a manufacturing organization?

Delphi technique is a qualitative technique of forecasting which is an opinion pool method, in which opinions of experts are pooled before arriving at a decision. However , the pooled opinion and decision is arrived at by consensus and not by compromise of opinion of experts.

Delphi technique is applied in a manufacturing organization in forecasting demand of customers, manpower requirement in future etc.

(ii) What are the merits and demerits of the Econometric Method of Demand forecasting?

Answer 15. (a)

The merits of Econometric Method of Demand forecasting are as follows:

I) Better understanding of complex 'cause and effect' relationships.

II) Allows testing of assumptions and judging the sensitivity of results to change in assumptions.

The demerits of Econometric Method of Demand forecasting are as follows:

I) Requires large volume of data.

II) Expensive

III) Non-availability of projected values of independent variables.

Q. 15. (c) Write short note on New Horizons in Manufacturing Technology :

Answer 15. (c)

During the last two decades, the manufacturing technology has undergone a dramatic change. Some of the jargons/new technology that are fast replacing the old technology are :

i) AMT- Advanced Manufacturing Technology includes some of the recent developed manufacturing techniques like: FMS(Flexible Manufacturing Systems), Robotics, Computer Aided Engineering, JIT(Just In Time), etc. CIM (Computer Integrated Manufacture is suitable for a large scale operation.

ii) For relatively medium scale unit, new technologies like Group Technology(GT), Cellular Manufacturing and Automated Storage and Retrieval System(AS/RS) is preferred.

iii) TQM(Total Quality Management)aims at building quality into a product right from the design/ purchasing/production stage.

iv) Other new techniques are:

- Kaizen
- BPR(Business Process Reengineering
- VFM(Value for Money)
- Kanban
- MRP(Manufacturing Requirement Planning) etc.

Q. 15. (d) A factory has three departments X, Y, and Z to manufacture two products A and B . Department 'X' can produce parts for 7000 units of A or parts for 12000 units of B per week but cannot do both at the same time, though parts for some A and For some B can be produced. Similarly Department 'Y' can produce 9000 parts for A or 6000 parts for B or combinations in between.

Final assembly is undertaken in department 'Z' with separate assembly lines for A and B with maximum capacities by 6000 and 4000 units respectively. Both lines can be operated at the same time. What is the optimal Product Mix?

Answer 15. (d)

Let the optimal quantity of the product 'A' be M numbers and optimal quantity of product 'B' be N numbers.

So constraints of 'X' will be

$M/7000 + N/12000 \leq 1$

Ignoring inequality,

$M/7000 + N/12000 = 1$

Or, $12 M + 7 N = 84000$———(i)

From the constraints of 'Y' department,

$M/9000 + N/6000 \leq 1$

Ignoring inequality,

$M/9000 + N/6000 = 1$

Or $6M + 9 N = 54000$————(ii)

From the constraints of Z department,

$M < 6000$————————(iii)

$N < 4000$————————(iv)

Solving equation (i)and (ii)

$12 M + 18 N = 108000$————(ii)*2———(v)

$12 M + 7 N = 84000$———(i)

Substracting (i) from (v)

$11 N = 24000$

$N = 2181.8$.

Substituting the value of N in Eq. (ii)

$6M+9*2182 = 54000$

Or, $6 M = 54000 – 19638$

Or, $6 M = 34362$

Or, $M = 5727$.

The values of M & N thus obtained satisfies the equations (iii) and (iv).

Therefore the optimal Product Mix is 5728 units of A & 2182 units of B.

Section II : Information Systems

Q. 1. (a) Expand the following abbreviations :

(i) DML
(ii) FDDI
(iii) B-ISDN
(iv) USART
(v) EFTS
(vi) IP
(vii) VSAM
(viii) EBCDIC
(ix) WORM
(x) DFD
(xi) HTTP
(xii) EDI
(xiii) VSAT
(xiv) ULSI
(xv) EPROM
(xvi) RISC
(xvii) DNS
(xviii) DDP
(xix) VRML
(xx) ALGOL

Answer 1. (a)

(i) Data Manipulation Language.
(ii) Fiber Distributed Data Interface.
(iii) Broadband- Integrated Services Digital Network.
(iv) Universal Synchronous /Asynchronous Receiver Transmitter.
(v) Electronic Fund Transfer System.
(vi) Internet Protocol.
(vii) Virtual Sequential Access Method
(viii) Extended Binary Coded Decimal Interchange Code.
(ix) Write Once Read Many.
(x) Data Flow Diagram
(xi) Hyper Text Transfer Protocol
(xii) Electronic Data Interchange.
(xiii) Very Small Aperture Terminal.
(xiv) Ultra Large Scale Integration.
(xv) Erasable and Programmable Read Only Memory.
(xvi) Reduced Instruction Set Computing.

(xvii) Domain Name System
(xviii) Distributed Data Processing.
(xix) Virtual Reality Modeling Language.
(xx) Algorithmic Language.

Q. 1. (b) Match Column I with relevant terms in Column II.

Column I	*Column II*
(A) Encryption	**(i) Communication between two pieces of hardware**
(B) Inverted tree	**(ii) Picture elements in individual dots.**
(C) Peer- to-peer	**(iii) Scrambling of Data.**
(D) Cache	**(iv) High speed buffer memory.**
(E) MIPS	**(v) Buffer storage to reduce processing delays.**
(F) Handshaking	**(vi) Use of more than one media for information presentation.**
(G) Hang-up	**(vii) Output device**
(H) Spooling	**(viii) Collection of computers with same access right as every other computer on the network.**
(I) Pixels	**(ix) Problem in hardware, control software or media**
(J) Multimedia	**(x) Measure of processing performance**
(K) LCD	**(xi) Hierarchical data structure**
(L) Scanner	**(xii) Relating to measurement of network speed**
(M) Bandwidth	**(xiii) Logical error**
(N) Bug	**(xiv) Input device**
(O) Broadband	**(xv) Different kind of transmission at the same time.**

Answer 2. (b)

(A) — (iii)
(B) — (xi)
(C) — (viii)
(D) — (iv)
(E) — (x)
(F) — (i)
(G) — (ix)
(H) — (v)
(I) — (ii)
(J) — (vi)
(K) — (vii)
(L) — (xiv)
(M) — (xii)
(N) — (xiii)
(O) — (xv)

Q. 2. (a) Complete the following sentences by putting an appropriate word in the blank position :

(i) The computer equipment and its components are collectively known as _____ .

(ii) The _____ consists of a number of digits or characters or a combination of both to denote an entity.

(iii) _____ is useful in designing logic circuits used by the processors of the computer system.

(iv) _____ is a problem solving system with close interaction between a man and a machine.

(v) A group of circuits interconnecting all sections of the microprocessor is called a _____ .

(vi) A _____ is a set of standards or rules.

(vii) Hybrid testing is also known as _____ testing.

(viii) _____ indicates a sequence of instructions that repeat until a predetermined count or other test is satisfied.

(ix) An _____ is a boundary shared by human beings and computer.

(x) _____ is a language system that delivers programs to users which can then be run on the users' machines.

(xi) _____ means browsing for information over the Internet.

(xii) _____ of a file arranges records within a file in some defined sequence.

(xiii) SAPAG is a popular _____ package.

(xiv) _____ is a pictorial representation of an algorithm.

(xv) In the Windows System, a Folder is a storage area for _____ .

(xvi) A symbol that marks to current position of the mouse on the screen or the point of entry of data is termed as _____ .

(xvii) Information of a permanent nature is stored in a _____ file

(xviii) _____ is computer to computer communication using a standard data format to exchange business information electronically between independent organizations.

(xix) _____ screen is an input device.

(xx) The total volume of work performed by the computer system over a given period of time is termed as _____ .

Answer 2. (a)

(i) hardware
(ii) Code
(iii) Boolean Algebra
(iv) DSS or Decision Support System
(v) bus
(vi) Protocol
(vii) sandwitch
(viii) Loop
(ix) Interface
(x) Java
(xi) Surfing
(xii) Sorting

(xiii) ERP
(xiv) Flow Chart
(xv) files and sub-folders
(xvi) cursor
(xvii) master
(xviii) EDI
(xix) Touch
(xx) throughput

Q. 2. (b) Choose the most appropriate answer from the four alternatives in the set :

(i) A network topology where all computers are connected to a central hub is called :
- **(A) Ring**
- **(B) Bus**
- **(C) Star**
- **(D) Token**

(ii) A number system with a base of 8 is known as :
- **(A) Binary**
- **(B) Decimal**
- **(C) Octal**
- **(D) Hexadecimal**

(iii) Which of the following is NOT an operating system?
- **(A) OS/2**
- **(B) Win XP**
- **(C) Oracle**
- **(D) UNIX**

(iv) A common coding language for the www is :
- **(A) HTML**
- **(B) Front page**
- **(C) Netscape**
- **(D) Listserver.**

(v) Transistor Technology was used in which generation of Computers?
- **(A) First**
- **(B) Second**
- **(C) Third**
- **(D) Fourth**

(vi) 'Firmware' is associated with :
- **(A) Application software for firms.**
- **(B) Special purpose hardware device.**
- **(C) Benchmark software.**
- **(D) Software in ROM.**

(vii) The concept of 'cylinder' is used in respect of the device :

(A) Tape Drive

(B) Disk Pack

(C) Compact Disk

(D) Daisy Wheel Printer.

(viii) Point-of- Sale or POS pertains to :

(A) Sales points plotted in computer graphics

(B) Sales between two locations

(C) A value that identifies the location of sales data in storage.

(D) An input-output device updating sales and inventory.

(ix) 'Packet switching' on the Internet refers to :

(A) Type of circuitry

(B) Switching components

(C) Method of data movement.

(D) Packet of hard copy of documents.

(x) One KB stands for :

(A) 100 bytes

(B) 10000 bytes

(C) 999 bytes

(D) 1024 bytes

Answer 2. (b)

(i) (C) — Star

(ii) (C) — Octal

(iii) (C) — Oracle

(iv) (A) — HTML

(v) (B) — Second

(vi) (D) — Software in ROM

(vii) (B) — Disk Pack

(viii) (D) — An input-output device updating sales and inventory.

(ix) (C) — Method of data movement

(x) (D) — 1024 bytes

Q. 2. (c) State whether following statements are True/ False :

(i) The CPU is considered the 'brain' of the computer.

(ii) HTML is a protocol used in Internet technology.

(iii) HLL converts source program into Machine Language Program.

(iv) A cyber appellate tribunal shall consists of one person only.

(v) Sequential files are suited for online inquiry processing.

(vi) CD-ROM are produced on a mass scale.

(vii) Trackballs in computers serve same purpose as a Modem does.

(viii) Virus and bug are not synonymous.

(ix) Binary equivalent of a terminating decimal fraction need not be terminating.

(x) A dumb terminal has an inbuilt processing capability.

(xi) Hacking is unauthorized access to software and information.

(xii) Bridge is used to connect two similar networks.

(xiii) DBMS software does not support query language.

(xiv) Cache memory operates between CPU and main memory.

(xv) Assembly language is machine independent.

Answer 2. (c)

(i) True
(ii) False
(iii) False
(iv) True
(v) False
(vi) True
(vii) False
(viii) True
(ix) True
(x) False
(xi) True
(xii) True
(xiii) False
(xiv) True
(xv) False

Q. 3. (a) What is Information? Explain the various methods of assessing information.

Answer 3. (a)

Information is data that has been processed into meaningful form so that it can be effectively interpreted and help the user in decision making. Information consists of data, text, images, voice etc. There are two methods of accessing information :

(i) Sequential or serial access where the information can be retrieved in the same sequence in which it is stored. Access time varies according to location desired. Sequential processing is suitable for application like payroll where the data for each and every employee are required to be processed at scheduled intervals. If an employee number is in the middle of a file , it can be reached only through searching all the employee numbers stored before it. Magnetic tape is a typical example of sequential access storage device.

(ii) Direct or random access where the information can be retrieved in a more direct or immediate manner. Random access signifies that the information is literally available at random or in any order. A random access storage device is one where it is possible to select any location in the device at random. Access to the information stored is almost direct. An appropriate equal access time is required for each location. Magnetic disk is a typical example of direct access storage device.

Q. 3. (b) Differentiate between open and closed systems.

Answer 3. (b)

A Closed System is self-contained and does not interact or make exchange across its boundaries with its environment. Closed systems do not get the feedback they need from the external environment and tend to deteriorate. A Closed Systems is one that has only controlled and well defined input and output. Participant in a closed system become closed to external feed back without fully being aware of it. Some of the examples of closed systems are manufacturing systems, computer programs etc.

Open System actively interact with other systems and establish exchange relationship. They exchange information, material or energy with the environment including random and undefined inputs. Open systems tend to have form and structure to allow them to adapt to changes in their external environment for survival and growth. Organizations are considered to be relatively open systems.

Q. 4. (a) Differentiate between :

(i) Primary Storage and Secondary Storage.

(ii) Microprocessor and Microcomputer.

(iii) CD ROM Disks and WORM Disks.

Answer 4. (a)

(i)

Primary Storage	Secondary Storage
(i) Primary Storage is the internal or main memory and is basic to all computer systems. This memory stores the programs under operation and the data which is being processed. It has a definite size and cannot be expanded off and on.	(i) Secondary Storage is called 'auxiliary storage' and is supplementary to the primary storage associated in CPU. Such memory is also called backup storage. It is used to hold programs not currently in use and data files. It has large capacity in relation to the primary storage.
(ii) The most popular form of Primary Storage is RAM.	(ii) The most popular secondary storage media are Magnetic Tape, Magnetic Drums etc.
(iii) The processing speed is very fast as compared to secondary storage.	(iii) It contributes to slower processing speed as compared to primary storage.

(ii)

Microprocessor	Microcomputer
(i) It is a device having tremendous processing capacity of doing logical and arithmetic processing.	It is a collection of various Input/Output devices, processor, etc. so as to form a complete computer.
(ii) All major calculations and comparisons as well as activating and controlling the operation of other units are performed by the microprocessor.	It can do all the activities of a micro processor plus more.
(iii) Microprocessor is a part of micro computer.	A microcomputer is a complete system in itself. When a microprocessor is combined with Input/Output and storage devices, it is called microcomputer.
(iv) Primary storage not available.	It has a primary storage unit.
(v) It cannot work 100% independently.	Can work 100% independently.
(vi) E.g. Intel IC (Integrated Chip)	E.g Apple, Machintosh, etc.

(iii)

CD ROM Disks	WORM Disks
(i) The data on Compact Disks(CD) is permanent and cannot be altered.	WORM Disk stands for 'Write Once, Read Many' which means data once written can only be read and cannot be changed or updated.
(ii) Its typical storage capacity is about 650 MB. Digital Video Disk (DVD) which looks like a CD is fast replacing CD's now. It can be used from both sides with each side capable of storing 4.7 GB of data.	The typical storage capacity of WORM Disk is about 200 MB.

Q. 4. (b) What is an interface device? Describe some commonly available interface device.

Answer 4. (b)

Interface device : An Interface device acts as a platform between the human-beings and the computer. It is a tool for communication between the various Input/Output devices and peripher-als of a computer system and the human-beings. Such a device makes it possible for human beings to properly communicate with the computer system such that the specified instructions are correctly understood by the system. Since a Computer cannot speak or listen, an Interface device acts as a media for effective communication between the Computer and the human-beings, such that the specified instructions are correctly understood.

The following are some of the commonly available interface devices :

- **Mouse :** This is the most common interface device on PCs. It has a rubber ball at the bottom and two or three switches at the top. When the mouse is moved on the desktop or on a pad, the pointer on the computer (mouse pointer) also moves on the screen of the computer. The rubber ball provides the movement of direction and a click on a switch on the mouse triggers action command to the computer.
- **Trackball :** This is similar to the mouse. The difference is that unlike the mouse the trackball is fixed on a case on the computer(usually on the base of the computer). The trackball is more .common in portable computers.
- **Joystick :** is another interface device used for the communication between the computer peripherals. This device has now become obsolete.
- **Light Pen :** This device is in the form of a pen and can be written directly on the screen. The pen contain electronic circuits/magnetic so that these are understood by the system.
- **Cursor :** is a communication device between the user and the machine.
- **Keyboard :** It contains various keys which when pressed indicates a specific communication to the processing device and the impact can be seen on the monitor.

  Apart from the above, mention can be made of some more interface devices like Digital pen, Voice Recognition, etc.,

Q. 5. (a) What is a virus scanner ? Briefly describe the functions of a virus scanner.

Answer 5. (a)

A Computer virus is a set of instructions purposely entered into the system to cause harm to the data stored in it or only to scare the user by appearing. In many cases, viruses can be highly destructive for organisation's DP System. A Computer virus often spreads itself by first infecting executable files or system areas of hard or floppy disks and then making copies of itself.

A Virus Scanner is a device /program, which takes care of locating the viruses and protecting the system by either removing the viruses or by not allowing them to do any harmful act. It is thus one kind of an anti-virus program that can spot a virus before the virus can cause any harm.

Virus Scanners are designed to help identify viruses within files, boot sectors, master boot sectors, memory and other hiding places and help to remove them. The capability to detect and identify a virus is probably the most important feature of a Virus Scanner.

Virus Scanners can be obtained from the market or can be downloaded from the Internet and installed in the system. Examples- Norton Antivirus, Gri-soft AVG Antivirus, Spy ware Doctor, just to name a few.

Q. 5. (b) (i) What is an application software?

(ii) PQR Ltd. is considering three options to acquire software for computerizing one of its important functional area . The options are :

(I) Buying the software package available in the market;

(II) Engaging software industries to design the software;

(III) Developing the software in-house with the help of their own IT people.

Answer 5. (b) (i)

Application software is aimed at a solution to a particular problem of the user of a computer system. It has direct interface with the computer system and provides standard processing utilities to solve the specific application problems of the user. For example, number of application software exists in the area of accounting and financial management.

Application software can be sub-divided into two categories viz. general-purpose and application-specific. General-purpose application software are programs that perform common information processing jobs for end users such as word processing programs, spreadsheet programs and database management programs etc. Application specific programs support specific applications of end users e.g. accounting package, inventory control, scientific analysis, computer assisted instruction programs in education etc.

Answer 5. (b) (ii)

The pros and cons of each of the options are enumerated below :

Type of software	Advantages	Disadvantages
(I) Buying ready made	(i) Can be seen and tested.	(i) May not meet requirements fully
	(ii) Will have fewer bugs	(ii) Enhancement/modifications may be expensive and time consuming.
	(iii) May be less costly	(iii) Requires development, testing and implementation time.
	(iv) Documentation/support facilities.	
(II) Developed by outside firm	(i) Better control over schedule and cost.	(i) Difficult to negotiate on effort and time required.
	(ii) Does not affect day-to-day operations due to development work.	(ii) Difficult to implement without adequate technical knowledge of the software.
	(iii) Ready skills when hardware or software platforms.	(iii) Difficult to maintain after implementation.
	(iv) Advantage of core competencies.	(iv) Unfamiliarity of the outside party about the business environment may hamper quality. (v) Maintenance support cost.

Type of software	Advantages	Disadvantages
(III) Developed in-house	(i) Familiarity with business will lead to better quality.	(i) Difficult to adhere to time schedule.
	(ii) Will meet requirements fully.	(ii) Additional manpower cost.
	(iii) Development of in-house skills.	(iii) Particular skills may not be available.
	(iv) Source of income by selling software or consultancy services.	(iv) Turnover of skilled personnel
	(v) Improvisation according to systems followed by other software.	(v) Advantages of core competencies may not be there,

Q. 6. (a) What is prototyping approaches to systems development? What are its advantages and shortcomings?

Answer 6. (a)

A Prototype is smaller version of system in terms of volume, complexity and cost. Prototyping technique is used to develop smaller systems such as decision support systems, management information systems and expert systems. The goal of prototyping approach is to develop a small or pilot version called a prototype of part or all of a system. A prototype is a usable system or system component that is built quickly and at a lesser cost, and with the intention of being modifying or replacing it by a full scale and fully operational system. Finally, when a prototype is developed that satisfies all user requirements, either it is refined and turned into the final system or it is scrapped. If it is scrapped, the knowledge gained from building the prototype is developing the real system.

Prototyping consists of following four steps :

1. **Identify Information System Requirements :** In traditional approach, the system requirements have to be identified before the development process start. However, under prototype, the process of determining them can be less formal and time-consuming than when performing traditional systems analysis.
2. **Develop the Initial Prototype :** In this step, the designers create an initial base model-for example, using fourth-generation programming languages or CASE tools. The main goal of this stage is 'rapid development' and 'low cost'.
3. **Test and Revise :** After finishing the initial prototype, the designers first demonstrate the model to users for experiment. At the outset, users must be told that the prototype is incomplete and requires subsequent modifications based on their feedback. Thus, the designers ask users to record their likes and dislikes about the system and recommend changes. Using this feedback, the design team modifies the prototype as necessary and then resubmits the revised model to system user for reevaluation. Thus interactive process of modification and reevaluation continues until the users are satisfied-commonly, through four to six interactions.
4. **Obtain User Signoff of the Approved Prototype :** At the end of Step 3, users formally approve the final version of the prototype, which commits them to the current design and establishes a contractual obligation about what the system will, and will not do or provide.

Advantages of Prototyping :

1. Prototyping requires intensive involvement by the system users. Therefore, it typically results in a better definition of the users' needs and requirements than does the traditional system development approach.
2. A very short time period (e.g., a week) is normally required to develop and start experimenting with a prototype. This short time period allows system users to immediately evaluate proposed system changes.
3. Since system users experiment with each version of the prototype through an interactive process, errors are hopefully detected and eliminated early in the developmental process. As a result, the information system ultimately implemented should be more reliable and less costly to develop than when the traditional systems development approach is employed.

Disadvantages of Prototyping :

1. Prototyping can only be successful if the system users are willing to devote significant time in experimenting with the prototype and provide the system developers with change suggestions.
2. The interactive process of prototyping causes the prototype to be experimented with quite extensively. Because of this, the system developers are frequently tempted to minimize the testing and documentation process of the ultimately approved information system. Inadequate testing can make the approved system error-prone, and inadequate documentation make this system difficult to maintain.
3. Prototyping may cause behavioral problems with system users. These problems include dissatisfaction by users if system developers are unable to meet all user demands for improvements as well as dissatisfaction and impatience by user when they have to go through too many interactions of the prototype.

Q. 6. (a) Write short notes on :

(i) Top down approach of system development.

(ii) End user development approach in system development.

Answer 6. (b)

(1) Top down approach of system development.

The top down approach assumes a high degree of top management involvement in the planning process and focuses on organizational goals, objectives and strategies. The logic here is that, above all, an information system needs to be responsive to and supportive of an organization's basic reasons for being. Hence the organization's goals should be the driving force behind development of all the computer systems. Thus, using top down approach, we begin analyzing objectives and goals of the organization and end by specifying application programs and modules that are needed to be developed.

Various steps in top-down approach are as follows :

(a) Analyze the objectives and goals of the organization in terms of profit, growth, diversification etc.

(b) Identify the functions of the organization and explain how they support the entire organization.

(c) Ascertain major activities, decisions and functions at various levels of hierarchy. It should be analyzed what decisions are made and what need to be made.

(d) Identify models that guide managerial decision process and find the information requirements for activities and decisions.

(e) Prepare specific information processing programs in detail and modules within these programs. Also identify files and database for applications.

(ii) End user development approach in system development.

With the increasing availability of low-cost technology, end user development is becoming popular. Here it is the end user and not the computer professional who is responsible for systems development activities. The number and nature of systems development activities followed by the end user often differ from those found in formal approaches. There are some risks involved. Enforcing standards and policies is unlikely to be carried out to the same degree as in other approaches. The end-user will not have the experience of an analyst in completing an accurate specification of system requirements. Hence, there would be a reduction in the quality assurance and stability of the system. As departments would choose their own software and hardware, an increase in unrelated and incompatible systems would result. Also difficulties in accessing could arise for users trying to access a central system.

Q. 7. (a) What is a database? What are the functions of DBMS?

Answer 7. (a)

Database refers to a logically coherent collection of data for a specific purpose e.g. predefined applications and access by identified user groups. A database is used by an organization to store its data from different operational areas so that they can be shared by each operation collectively. A database has similarity of the real world called mini-world or Universe of Discourse (UoD) reflecting changes in the mini world.

Database Management System (DBMS) is a collection of programmes utilized for creating and maintaining a database for benefit of the users. DBMS is thus a general –purpose software system that enables defining, constructing and manipulating databases for various applications by properly authorized multiple users without compromising the security and integrity of data.

DBMS offers the following services :

Defining a database means specifying data types, structures, and constraints for data which will be stored in the database.

Constructing the database refers ti the process of storing the data in the storage medium which will be controlled by the DBMS.

Manipulating a database refers to the functions involved in updating the database, generating reports from the data in the database, querying the database to retrieve specific data.

Q. 7. (b) What is the role of –

(i) System Analyst, and

(ii) Database Designer

Answer 7. (b)

(i) The role of System Analyst is :

- To analyze existing systems, procedures and documents
- To develop ideas for improved/new system
- To design system specifications with input, output and file specifications
- To design control system with audit trail
- To define actions/decisions/error messages under various conditions
- To prepare user and operations manual
- To prepare implementation plan(parallel/pilot/phased/direct switch over)
- To prepare program specifications with test data and monitoring results
- To provide guidance to programmers
- To make interaction with users

(ii) The role of Database Designer is :

- To communicate with the prospective database users to assess the requirements
- To identify the data to be stored in the database
- To choose appropriate structure to represent and store the data
- To implement the final database design which should be capable of supporting the requirements of all user groups.

Q. 7. (c) Who are the end users in a database environment?

Answer 7. (c)

End users are the persons who require access to the database for querying, updating, and generating reports. Databases exist primarily for their use. Depending on the nature of use, end users may be categorized under four heads as under :

- Occasional or casual users who learn only a few of the facilities used repeatedly.
- Naïve or parametric users who constitute majority of users who are constantly querying and updating the database for standard types of transactions. Their knowledge is limited to the use for their specific requirement of standard nature.
- Sophisticated users like engineers, scientists, analysts etc . who use the facility to meet their complex requirements. They learn most of the features of DBMS to fulfill their special requirement.
- Stand-alone users maintaining personal database who become expert in using the specific software package by day-to-day use.

Q. 8. (a) Describe the following terms :

(i) Domain Name

(ii) Gateways

(iii) Client

Answer 8. (a)

(i) **Domain Name —** It refers to the unique name that identifies an internet site. Domain name always have two or more parts, separated by dots. The part on the left is the most specific and the part on the right is most general. A given machine may have more than one domain name but a given domain name points to only one machine. For e.g icwai.org, icsi.org etc

(ii) **Gateways —** It is used to connect two dissimilar networks but do not possess network management facilities. They are used to connect LANs of different topologies e.g. Bus and Ring Network.

(iii) **Client —** It is a software that is used to contact and obtain data from a server software program on another computer, often across a great distance. Each client program is designed to work with one or more specific kinds of server programs. A web browser is a specific kind of client.

Q. 8. (b) Distinguish between :

(i) Serial transmission and Parallel transmission

(ii) Centralized Processing and Distributed Processing

(iii) Ring network and Star network

Answer 8. (b)

(i)

Serial transmission	Parallel transmission
In case of Serial transmission, one bit of data is transferred at a time. A serial port which facilitates serial transmission data is used for the installation of Mouse/Modem. It is a cheap mode of data transfer. Data can be transferred to long distances. However, in serial transmission, data transfer is slow	In case of parallel transmission, a complete byte of data is transferred at a time. Centronic and IEEE are examples of Parallel ports used to connect Printer/Scanner. In parallel transmission, data transfer is fast. However, it is an expensive mode of data transfer. Also, data cannot be transferred to long distances

(ii)

Centralized Processing	Distributed Processing
Complete data is processed by central host computer.	Data is processed locally at the user work-station but stored in the central host computer for sharing of data among various users.
All the database files are stored on the central host computer, hence security of data is of major consideration which requires regular backup.	Database files are physically distributed among various users as Partitioned database or Replicated database. Backup of data is taken by individual user.
Dumb Terminals/Intelligent Terminals are used.	Intelligent Terminals are used.
Central host computer is required to be of high speed, usually mini or mainframe computer, as entire workload is on the main CPU.	Central host computer known as Server can be even a microcomputer since data is processed by user workstations.
Waiting time of a user can be high, as main CPU may be busy in processing the data of other users.	Data is processed immediately; hence waiting time of users is less.
Terminals are connected with central host computer using high-speed communication link, which communicate with host computer frequently to access/process the data. Hence, communication expenditure is more.	Communication expenditure is less, as terminals called nodes communicate with server occasionally for data access.
Failure of Central host computer will paralyze the entire network.	Failure of server will not completely breakdown the entire network.

(iii)

Ring network	Star network
In Ring network, the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is a direct point-to-point link between two neighboring nodes. These links are unidirectional which ensures that transmission by a node traverses the whole ring and comes back to the node, which made the transmission.	In Star network, each computer is connected by cable segments to a centralized component called a hub. That is, processing nodes in a star network interconnect directly with a central system. Each terminal, small computer, or large mainframe can communicate only with the central site and not with other nodes in the network. If it is desired to transmit information from one node to another, it can be done only by sending the details to the central node, which in turn sends them to the destination.

Ring network	Star network
Ring networks offer high performance for a small number of workstations or for larger networks where each station has a similar workload. These networks can span longer distances than other types of networks and are easily extendable.	A star network is particularly appropriate for organizations that require a centralized data base or a centralized processing facility. In a Star network, it is easy to add new nodes and also remove nodes. A node failure does not bring down the entire network.

Q. 8. (c) Explain the various functions of communications software.

Answer 8. (c)

Communications software manages the flow of data across a network. It performs the following functions :

(i) **Access control :** Linking and disconnecting the different devices, automatically dialing and answering telephones; restricting access to authorized users; and establishing parameters such as speed, mode and direction of transmission.

(ii) **Network management :** Polling devices to see whether they are ready to send or receive data; queuing input and output; determining system priorities; routing messages, and logging network activity, use and errors etc.

(iii) **Data and file transmission :** Controlling the transfer of data, files and messages among the various devices.

(iv) **Error detection and control :** Ensuring that the data sent was indeed the data received.

(v) **Data security :** Protecting data during transmission from unauthorized access.

Q. 9. (a) State various software tools used in Decision support system.

Answer 9. (a)

Decision support system includes a variety of software supporting database query, modelling, data analysis and display. These tools fall under following four categories :

(i) **Database languages :** Tools supporting database query and report generation use mainframe, mini computer and microcomputer based databases. FOCUS, RAMIS and NOMAD II are mainframe based languages supporting data base query, report generation and analysis. FOCUS, RAMIS are also available in PC version. MS Access is one of the most popular database query package used in Window based PC.

(ii) **Model based Software :** Model based analysis tools such as spreadsheet software enable manager to design models that incorporate business rules and assumptions. Lotussuits and MS-Excel supports model building and "what if" type analysis. Modelling tools like IFPS are designed to support financial modelling and analysis.

(iii) **Statistics and Data Manipulation tools :** Statistical analysis software such as SAS, SPSSS supports market researchers, operation research analysts and other professionals using statistical analysis functions and are generally used on mainframe computers. Microcomputer-based statistical packages are available as well.

(iv) **Display based DSS :** Graphic displays of output generated from MS-Excel are very effective in management presentation. Graphics tools running in a mainframe environment include DISSPLA, TELLAGRAF and SASGRAPH. Microcomputer based tools such as Harward Graphics, and Power Point display output in the form of pie charts, bar charts and graphs.

An integrated module of MS-Excel and Power-Point that provides the ability to generate, manipulate and statistically analyse data is best example of query, modelling and display software.

Q. 9. (b) What is meant by E-Commerce? Mention some advantages offered by E-Commerce.

Answer 9. (b)

Electronic Commerce or E-commerce refers to conducting business electronically with customers including advertising, marketing, order processing, payment, customer support etc. For international contracts for selling of goods, writing is not required. E-business requires provisions for :

- Electronic signature
- Cryptography
- Authentication, and
- Certification.

Application of e-commerce includes e-mail, electronic bulletin board, electronic funds transfer etc. It requires new skills, strategies, and technologies.

Advantages of E-commerce are many of which the following are the major ones :

(i) Paperless exchange of information using EDI or Electronic Data Interchange technology.
(ii) Communication (E-mail etc.)
(iii) Electronic Bulletin Board and Conferencing
(iv) Electronic Fund Transfer
(v) Expansion of market scope and scale
(vi) Cutting down marketing intermediaries
(vii) (Reduction in purchasing , sales and marketing costs
(viii) Fast and interactive services to the consumers round the clock
(ix) Increasing domestic and international trade
(x) Reduction in inventories
(xi) Lowering of cycle time
(xii) Speedier and cheaper method of access, communications, and processing
(xiii) Increasing competitiveness and profitability.

Q. 10. Executive Information System is different from Traditional Information System. Do you agree? Justify your answer.

Answer 10.

Executive Information System (EIS) is a tool that provides direct on-line access to relevant information, in a useful and navigable format, about aspects of a business that are of particular interest to the senior manager.

These systems are designed in such a format so that they can be used by individuals with limited time, and limited knowledge of operating computers to search information relating to broad strategic issues and then explore the information to find the root causes of those issues.

Executive information systems differ from traditional information systems in the following ways.

1. They are specifically tailored to executive's information needs.
2. They are able to access data about specific issues and problems as well as aggregate reports.
3. They provide extensive on-line analysis tools including trend analysis and exception reporting etc.
4. They can access a broad range of internal and external data.
5. They are particularly easy-to-use (typically mouse or touch- screen driven).
6. They are used directly by executives without assistance.

7. All EISs are delivered through terminals using easy-to-use software.
8. Information tends to be presented by pictorial or graphical means, whereas in most traditional information systems, information is usually presented in numerical or textual form, usually in printed report format.
9. Information is presented in summary format e.g. sales for the whole company. There is the facility to drill down to the other levels of information to see how the sales figures were arrived at – by geographical location, by product group etc.
10. The ability to manipulate data, to project 'what if' outcomes and to work with modeling tools within the system are also evident in EIS. This is particularly so with external information that can be super imposed on to the company's information e.g. sales forecasts with information from the meteorological office about the weather.

Q. 11. (a) Give a definition of MIS. Why are information systems for managers difficult to design and build?

Answer 11. (a)

A management information system or MIS is an information system making use of available resources to provide managers at all levels in all function with information from all relevant sources to enable them to make timely and effective decisions for planning , directing and controlling the activities for which they are responsible.

A MIS is a comprehensive and coordinated set of information sub-systems which are rationally integrated and which transform data into in a variety of ways to enhance productivity in conformance with managers' styles and characteristics on the basis of established quality criteria.

Information Systems are difficult to design and build due to the following reasons :

(i) Much of the information needed by the managers are future oriented or comes from outside sources.

(ii) Much of the information needed by the managers is for one-of-a-kind, which are difficult to anticipate and provide for in the system.

(iii) Managers receive much of their information from discussions with people rather than from reports and statements.

(iv) Managers and computer professionals often fail to understand each other. Channel of communication between them are often blocked by misconceptions, misunderstandings and jargons.

(v) Many managers lack computer and systems knowledge, and hence lack trust in MIS.

(vi) Computer professional do rarely understand management processes. Hence, MIS designed and build by them often fail to satisfy the managers

Q. 11. (b) Describe three broad categories of the information requirements of managers.

Answer 11. (b)

The information requirements of managers can be divided into three broad categories :

(i) **Environment information: It consists of the following :**

Government policies : Information about concessions/benefits, government policies in respect of tax concessions or any other aspects, which may be useful to the organization in the future period.

Factors of production : Information related with source, cost, location, availability, accessibility and productivity of the major factors of production viz., (i) labour, (ii) materials and parts and (iii) capital.

Technological environment : Forecast of any technological changes in the industry and the probable effect of it on the firm.

Economic trends : It includes information relating to economic indicators like consumer disposal income, employment, productivity, capital investment etc. Such information is valuable for those firms specially whose output is a function of these important variables.

(ii) **Competitive information :** It includes the following information.

Industry demand : Demand forecast of the industry in respect of the product manufactured and in the area in which the firm would be operating.

Firm demand : Assessment of the firm's product demand in the specified market. It also includes an assessment of firm's capability to meet firm's demand.

The competitive data : Data of competing firms for forecasting demand and making decisions and plans to achieve the forecast.

(iii) **Internal information :** It usually includes information concerning organizations' (a) sales forecast, (b) financial plan/budget, (c) supply factors, and (d) policies, which are vital for subsidiary planning at all levels in the organization.

Q. 12. (a) "It is better to depend on reputed ERP software pacakages than to develop such packages internally."

(i) Do you agree with the above opinion? Furnish the reasons in support of your decision.

(ii) On implementation of ERP, what will be the changes in the information processing system?

Answer 12. (a)

(i) In to-day's rapidly changing business environment every organisation has to face new markets, new standards of quality assurance, new competition, increasing customer expectations etc. As a result business enterprises are in constant need of reviewing and re-engineering their processes in order to survive and grow under competitive environment. It is therefore essential to have a well-knit information system, timely decision making process and aggressive cost control measures through implementation of ERP. There may be a number of reasons for such opinion e.g.

- It may not be cost effective
- It may not be their prime line of business.
- Lead-time may be considerable.

In view of above, organizations mostly prefer to rely on packaged software in order to meet their specific requirements as well as ensure enterprise wide application.

Use of packaged software is recommendable since

- it is built wIth many years of industry experience,
- it is an established and proven system, and
- it incorporates standard practices.

Any attempt to develop such elaborate and complex software would involve substantial time, effort, and cost as if to re-invent the package.

(ii) On implementation of ERP, the following will be the changes in the information processing system :

- On-line instead of batch processing
- Client-server systems
- Relational database management systems
- Graphical user interfaces
- Web-based applications

Any change in the information technology will have consequent effect on the business technology for adapting to such changes e.g. electronic commerce, digital cash, etc.

Q. 12. (b) What is an automated office? List the automated office components along with their major functions.

Answer 12. (b)

Automated office is a multifunction integrated computer based system that allows many office activities to be performed in an electronic mode. It is a new way of preparing documents and enhanced communication method. It places the power of computing in hands of office executives. It helps in filing, storing and retrieving documents.

Components of the automated office and major functions thereof are :

(i) *Word processing* — It provides preparation of typed document in different ways, their storage, revision and printing.

(ii) *Electronic Mail* — It allows typed message to be sent to or received from any part of the world electronically.

(iii) *Voice Mail* — It facilitates spoken message to be sent to or received from any part of the world electronically.

(iv) *Facsimile* — It allows any typed or handwritten or printed documents to be sent to or received from any part of the world electronically.

(v) *Tele-conferencing* — It facilitates conferencing or meeting among persons located at different places.

(vi) *Personal computing* — It places computing decision support at workers' fingertips.

(vii) *Reprographics* — A combination of automated machines for providing multiplicities of documents like photocopies, scanners, laser printers etc.

Q. 13. (a) List various access control methods used for safety of the database.

Answer 13. (a)

In data base environment, access is controlled based on the degree of sensitivity of the data in the database. The users are categorized on the basis of permission to be given for access to different levels of data on the basis of sensitivity and control is made by the database administrator. Control risks include corruption, theft, misuse and destruction of data. These originate from both unauthorized intruders and authorized users who exceed their access privileges. Several data base access control features are discussed below :

(i) User View **–** The user view or sub-scheme is a subset of the total database that defines the user's data domain and provides access to the database. Though the DBA has primary responsibility for user view design, he works closely with users and system designer in this task. Access privileges to the data, as defined in their view, should commensurate with the user's legitimate needs. User view can restrict user access to a limited set of data, they do not define task privileges such a read, delete or write. Often several users may share a single user view but have different authority levels.

(ii) Database Authorization Table **-** The database authorization table contains rules that limit the actions a user can take. Each user is granted certain privileges that are coded in the authority table, which is used to verify the user's action requests.

(iii) User-defined Procedures **-** A user defined procedure allows the user to create a personal security program or routine to provide more positive user identification than a single password can. For example, the security procedure asks a series of personal questions, which only the legitimate user is likely to know.

(iv) Data Encryption **-** Many database systems use encryption procedures to pocket highly sensitive data, such as product formula, personnel pay rates, password files and certain financial data. Data encryption uses an algorithm to scramble selected data, thus making it unreadable to an

intruder browsing the database. In addition to protecting stored data, encryption is used for protecting data that are transmitted across networks.

(v) Biometric Devices - Biometric devices measure various personal characteristics such as fingerprints, voiceprints, retina prints or signature characteristics. These user characteristics are digitized and stored permanently in a database security file or on an identification card that the user carries. When an individual attempts to access the database, a special scanning device captures his or her biometric characteristics, which are compared with the profile data stored internally or on the ID Card. If the data do not match, access is denied.

Q. 13. (b) Distinguish between :

(i) General Controls and Application Controls.

(ii) Network-level firewalls and Application-level firewalls.

Answer 13. (b)

(i)

General Controls	Application Controls
General controls apply to a wide range of exposures that systematically threaten the integrity of all applications processed within CBIS environment.	Application controls are focused on exposures associated with specific systems such as payroll, accounts receivable etc. These controls help to ensure the completeness and accuracy of transaction processing, authorization, and validity

(ii)

Network-level firewalls	Application-level firewalls
Network-level firewalls provide low cost and low security access control. This type of firewall consists of screening router that examines the source and destination addresses that are attached to incoming message packets. The firewall accepts or denies access requests based on filtering rules that have been programmed into it.	Application-level firewalls provide a high level of customizable network security, but can be extremely expensive. These systems are configured to run security applications called proxies that permit routine services such as e-mail to pass through the firewall, but can perform sophisticated functions such as logging or user authentication for specific tasks. If an outside user attempts to connect to an unauthorized service or file, the network administrator or security group can be notified immediately.

Q. 13. (c) Briefly explain five categories of Computer frauds based on the data processing model.

Answer 13. (c)

Based on data processing model computer frauds can be categorized into following categories :

(i) **Input :** The simplest and most common way to commit a fraud is to alter computer input, it requires little, if any, computer skills. Instead, perpetrators need only to understand how the system operates so that they can cover their tracks. Collusive fraud, disbursement frauds, payroll and receipt frauds are examples of computer frauds committed through computer input.

(ii) **Processor :** Computer fraud can be committed through unauthorized system use, including the theft of computer time and services. For example, some companies do not allow their employees to use company computers to keep personal or outside business records. Violating this policy would constitute a fraud. Similarly, employee goofing is also considered to be computer fraud.

(iii) **Computer instructions :** Computer fraud can be accomplished by tampering with the software that processes company data. This may involve modifying the software, making illegal copies of software or using it in an unauthorized manner. It might also involve developing a software program or module to carry out an unauthorized activity. This approach to computer fraud used to be one of the least common, because it requires a specialized knowledge of computer programming that is beyond the scope of most users.

(iv) **Data :** Computer fraud can be perpetrated by altering or damaging a company's data file or by copying, using them without authorization. There have been numerous instances of data files being scrambled, altered or destroyed by some selfish employees.

(v) **Output :** Computer fraud can be carried out by stealing or misusing system output. System output is usually displayed on monitors or printed on paper. Unless properly safeguarded, monitor and printer output is subject to pry eyes and unauthorized copying.

Q. 14. (a) What are information system audit and its key elements?

Answer 14. (a)

Information system audit refers to any audit that encompasses wholly or partly reviews and evaluation of automated information processing systems, related non-automated process and the interface between them. The key elements of any audit are :

- Objective review of the audit environment.
- Assertions, which can be verified.
- An independent person other than auditee who does audit.
- There is a standard criteria (GAAP) used as bench mark.
- It culminates in issuing an option report incorporating the findings, conclusions with recommendations as required.

Q. 14. (b) Narrate the basic objectives of IS Audit.

Answer 14. (b)

The basic objectives of Information System Audit are as follows :

- Safeguarding of assets which include hardware, software, people i.e knowledge, data files, system documentation etc.
- Data integrity i.e completeness, soundness, purity and veracity.
- System effectiveness i.e it has knowledge of user needs and facilitates decision making process in the organization, and
- System efficiency i.e use of minimum resources to fulfill the desired objectives, and
- Statutory compliance i.e rules, regulations, or conditions to be compiled with under various Acts, Laws, Regulations etc.

Q. 14. (c) What is the role of an IS Auditor?

Answer 14. (c)

The Information System (IS) auditor is responsible for establishing control objectives that reduce or eliminate potential exposure to control risks. After the objectives of the audit have been established, the auditor must review the audit subject and evaluate the results of the review to find out areas that need some improvement. IS auditor should submit a report to the management, recommending actions that will provide a reasonable level of control over the assets of the entity.

Q. 14. (d) Explain the steps involved in conducting audit of computerized accounting system.

Answer 14. (d)

Steps involved to conduct audit of computerized accounting system are as follows :

(i) Understanding basic features of the computer based system
- Input documentation
- Accounting System
- Management Information System
- Control System

(ii) Review of application documentation
- Data contents
- Procedures
- Internal Control
- System flow Charts
- Input formats
- Record layouts
- Coding system
- Exception

(iii) Evaluation of Controls
- Preparation of control techniques
- Appraisal of key activities

(iv) Designing test procedures
- Choosing testing techniques
- Testing processing operations

(v) Using computers as audit tools
- Test check
- Generalized audit program

(vi) Preparation of audit program
- Compliance tests
- Evaluation of audit results
- Reporting to management.

Q. 15. (a) Explain Cyber laws and their legal framework in India.

Answer 15. (a)

Cyber Laws - Cyber laws refers to all the legal and regulatory aspects of Internet and World wide web. In other words Cyber laws form the legal and security frame-work for carrying out all security transactions over the w.w.w. Any activities in the Cyber space, which may turn into a legal issue, come within the purview of Cyber laws.

The law of Information Technology is one branch of Cyber laws, which regulates Information Technology and governs information storage, processing and communication. This law is similar in principles to the other existing laws like the law of contract, law of tort, law of crimes, law of evidence etc.,

Cyber laws deals with the application of existing conventions to new facts, arising out of the use of Computer Systems. methods and technology by which information is transmitted, the need for recognition of electronic records, electronic signature, E-Commerce und their allied matters.

The legal framework for Cyber laws :

The legal framework of Cyber laws for carrying secure transactions over the w.w.w is the 'Information Technology Act 2000' as far as India is concerned. In simple words, 'Information Technology Act, 2000' is an act to provide legal recognition for all the transactions carried out by means of electronic data interchange and other means of electronic communication (commonly referred to as E-Commerce).

This Act wiII go a long way to facilitate E-Commerce and provides legal recognition of all electronic records and digital signatures.

This Act further helps in preventing possible misuses arising out of transactions and other dealings concluded over the electronic medium and creates civil and criminal liabilities for any contravention of the provisions as laid down in the Act;

Sec. 14, 15, and 16 of the Act deals with integrity and authentication of secure electronic records and secure digital signatures.

Keys are large binary nos. that cannot be easily remembered or spoken. They are used to modify the encryption/decryption process.

Q. 15. (b) What are private key and public key? Discuss their impact with relation to digital signature and e-business transactions.

Answer 15. (b)

'Private Key' means the key of a key pair used to create a digital signature. Digital signature means authentication of any electronic records by any subscriber by means of an electronic method or procedure. Digital signatures do for electronic documents what the hand-written documents do for printed documents.

'Public Key' means the key of a key pair used to verify a digital signature created by the private key.

In an asymmetric crypto system, 'key pair' signifies a private key and its mathematically related public key.

The impact of 'Private Key' and 'Public Key' with relation to digital signature and e-business transactions.

A subscriber shall be deemed to have accepted a Digital Signature Certificate if he publishes/authorizes the publication of a Digital Signature Certificate to one/more persons or in a repository. By accepting a Digital Signature Certificate, the subscriber certifies to all who reasonably rely on the information contained in the Digital Signature Certificate that the subscriber holds the Private Key corresponding to the Public key listed in the Digital Signature Certificate and is entitled to hold the same.

Digital signature is verified by the process of checking the Digital signature by reference to the original message and a given public key and-determining whether the digital signature was created for that same message, using the private key that corresponds to the referenced public key.

Every subscriber shaII, exercise reasonable care to retain control of the private key corresponding to the public key listed in his Digital Signature Certificate and take all steps to prevent its disclosure to a person not authorized to affix the digital signature of the subscriber.

If the private key corresponding to the public key listed in the Digital Signature Certificate has been compromised, then, the subscriber shall communicate the same without any delay to the Certifying Authority in such manner, as may be specified by the regulation.

Q. 15. (c) What is a Certifying Authority? Mention the functions of Certifying Authorities in India in context of digital signature.

Answer 15. (c)

A Certifying Authority is a person who has been granted a license to issue digital signature certificates. These Certifying Authorities are to be supervised by the Controller of Certifying Authorities appointed by Central Government. Deputy or Assistant Controllers may also assist the Controller. The Controller will normally regulate and monitor the activities of the Certifying Authorities and lay down procedure of their conduct.

The following are the important functions of Certifying Authorities in India in the context of digital signature :

(i) Issue of public and private key as a functioning pair.

(ii) Compliance with IT Act 2000

(iii) Publishing the certificate and the subscriber accepting the same.

(iv) Ensuring that the information in Digital Signature is accurate.

(v) Ensuring that all the systems used are free from intrusion and misuse.

Q. 15. (d) Explain the terms Attribution, Acknowledgement and Dispatch of Electronic Records with reference to The Information Technology Act, 2000.

Answer 15. (d)

Chapter IV of the Information Technology Act 2000 explicates the manner in which electronic records are to be attributed, acknowledged and dispatched. These provisions play a vital role while entering into agreements electronically.

Section 11 states that an electronic record shall be **attributed** to the originator as if it was sent by him or by a person authorized on his behalf or by an information system programmed to operate on behalf of the originator.

As per Section 12, the addressee may **acknowledge** the receipt of the electronic record either in a particular manner or form as desired by the originator and in absence of such requirement, by communication of the acknowledgement to the addresses or by any conduct that would sufficiently constitute acknowledgement.

Section 13 specifies that an electronic record is said to have been **dispatched** the moment it leaves the computer resource of the originator and said to be received the moment it enters the computer resource of the addressee.