

V.S.B ENGINEERING COLLEGE, KARUR

DEPARTMENT OF MECHANICAL ENGINEERING

Sub. Code/Name: ME6005 -Process Planning & Cost Estimation

Year/Sem: IV/VII

UNIT-I

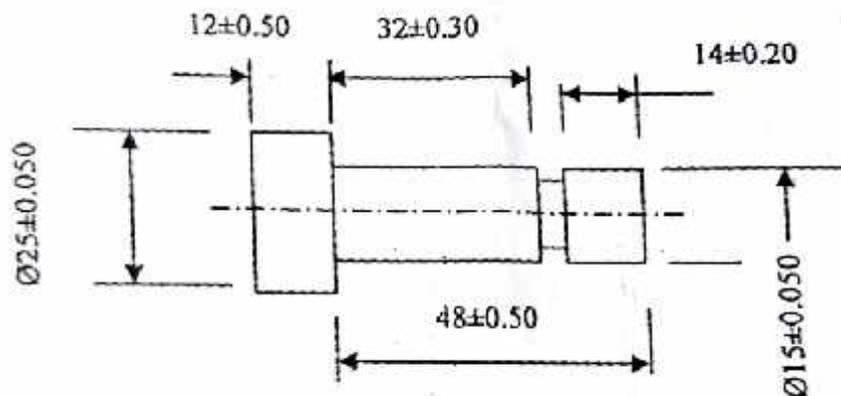
Part-A (2 Marks)

1. Define Process planning.
2. What are the process planning activities?
3. What are the types of process planning?
4. Define Generative CAPP systems.
5. What are all the types of drawing?
6. What are the stages in Process selection?
7. Brief about scope of process planning.
8. What are the documents used in process planning?
9. Define the term "Route sheet"
10. Write any four cutting tool materials.
11. List the objectives of process planning.
12. What are the types of process chart?
13. What do you mean by standard time?
14. Where string diagram is used?
15. What are the methods used for selection of machinery?
16. Define product design.
17. What designing includes in product design?
18. What are factors influencing the Operational Aspects in product analysis?
19. What is bilateral tolerance?
20. What is the use of collective assembly drawings?

Part-B (16 Marks)

1. What are the factors that influence process planning? Discuss.
2. Explain tool selection method.
3. Explain the various approaches to process planning.

4. List and explain the various factors considered for tooling selection.
5. Explain the various factors considered in product selection.
6. Explain the various types of drawing in details.
7. What are the procedures to be followed for the machine selection? Explain.
8. In the design of a jet engine part, the designer has a choice of specifying either an aluminium alloy casting or a steel casting. Either material will provide equal service, but the aluminium casting will weigh 1.2 kg as compared with 1.35 kg for the steel casting. The aluminium can be cast for Rs. 80.00 per kg. and the steel one for Rs. 35.00 per kg. The cost of machining per unit is Rs. 150.00 for aluminium and Rs. 170.00 for steel. Every kilogram of excess weight is associated with a penalty of Rs. 1,300 due to increased fuel consumption. Which material should be specified and what is the economic advantage of the selection per unit?
9. Discuss the production equipment and tool selection for the component show in fig. Under cut diameter is 12 mm



10. What are the factors that influence tool selection? Discuss.
11. What are the factors that affecting in equipment selection.
12. Explain the various methods of process planning.
13. Discuss in steps in tooling selection method.
14. Describe the set of documents required in process planning.
15. Explain the steps in process selection with suitable examples
16. Explain the factors considered in product selection
17. Two alternatives are under consideration for a tapered fastening pin. Either design will serve the purpose and will involve the same material and manufacturing cost except for the lathe and grinder operations. Design A will require 16 hours of lathe time and 4.5 hours of grinder time per 1,000 units.

Design B will require 7 hours of lathe time and 12 hours of grinder time per 1,000 units. The operating cost of the lathe including labour is Rs. 200 per hour. The operating cost of the grinder including labour is Rs. 150 per hour. Which design should be adopted if 1,00,000 units are required per year and what is the economic advantage of the best alternative?

18. In the design of buildings to be constructed in Alpha State, the designer is considering the type of window frame to specify. Either steel or aluminium window frames will satisfy the design criteria. Because of the remote location of the building site and lack of building materials in Alpha State, the window frames will be purchased in Beta State and transported for a distance of 2,500 km to the site. The price of window frames of the type required is Rs. 1,000 each for steel frames and Rs. 1,500 each for aluminium frames. The weight of steel window frames is 75 kg each and that of aluminium window frame is 28 kg each. The shipping rate is Re 1 per kg per 100 km. Which design should be specified and what is the economic advantage of the selection?

UNIT-II

Part-A (2 Marks)

1. What is the objective of process planning?
2. What are the functions of process planning?
3. What are factors consider for Economic analysis?
4. What are the aims of break-even analysis?
5. What are the assumptions in break-even analysis?
6. What you mean by break-even point?
7. What are the methods of determination of break-even point?
8. Define Cutting speed.
9. What do you mean by Break-even point in terms of Sales Value?
10. Define contribution
11. What do you mean by margin of safety?
12. What are the limitations of break-even analysis?
13. Write the concept of process planning?
14. What are the information required to preparing operation planning sheet?
15. Write the procedure of process planning.
16. Define work holding device.
17. What is mean by Jigs?
18. What are the elements of jigs and fixtures?

19. What are the factors affecting feed rate?

20. Define depth of cut.

PART B

1. What are the main process parameters than can influence the success of the machining?

2. What is the purpose of a work holding device? List the types of work holding devices.

3. List out the set of documents that are required for process planning.

4. What do you understand by break even analysis? List the objectives.

5. List the various factors that influence the design or selection of a work holder.

6. What is meant by cutting speed? Also list the major factors that are to be considered during selection of cutting speed.

7. What is meant by feed rate? List the major factors that are to be considered during the selection of feed rate.

8. Discuss about the factors to be considered in the selection of jigs and fixtures for cost reduction.

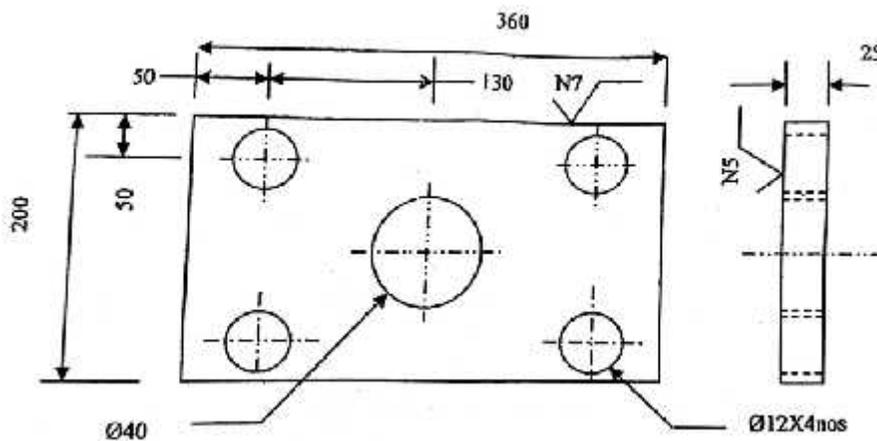
9. Explain on economics of process planning.

10. From the following data, calculate break-even point expressed in terms of units and also the new break-even point, if selling price is reduced by 10%. Fixed expenses; Depreciation = Rs.1,25,000; Salaries = Rs. 1,00,000 ; Variable expenses; Materials = Rs. 4 per unit; Labour=Rs. 2 per unit; Selling price Rs.15 per unit

11. Discuss about the factors to be considered for selection of depth of cut.

12. Alpha Associates has the following details; Fixed cost = Rs. 20, 00,000; Variable cost per unit = Rs. 100; Selling price per unit = Rs. 200; Find (a) The break-even sales quantity (b) The break-even sales (c) If the actual production quantity is 60,000 Find (i) Contribution (ii) Margin of safety by all methods.

13. Prepare the operation planning sheet for the given component.



14. Consider the following data of a company for the year 2016 ; Sales = Rs. 1, 20,000 Fixed cost = Rs. 25,000; Variable cost = Rs. 45,000; Find the following: (a) Contribution (b) Profit (c) BEP (d) M.S.

UNIT-III

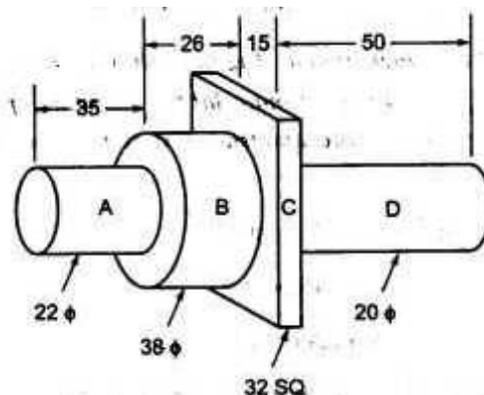
Part-A (2 Marks)

1. What is meant by Cost estimation?
2. Define costing.
3. Define cost accounting.
4. What do you mean by catalogue price?
5. What are the objectives of costing?
6. State the functional estimating.
7. What is direct material cost?
8. What is indirect material cost?
9. What is direct labour cost?
10. What is setup time?
11. What do you understand by estimating?
12. What are the types of estimator?
13. What is prime cost?
14. Name a few methods of cost estimates.
15. What do you mean by multiple cost method?
16. State some functions of estimating.
17. Give the methods of costing.
18. What is make or buy decision?
19. What is the difference between cost estimating and cost accounting?
20. What are the constituents of a job estimate?
21. What do you mean by a realistic estimate?
22. What are allowances in estimation?

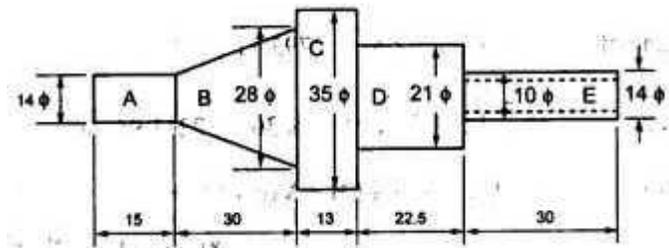
Part-B (16 Marks)

1. State and explain the objectives of cost estimation.
2. Discuss in details about the types and methods of estimating.

3. What are all the three methods used in conceptual cost estimation.
4. Explain the procedure involved in cost estimation.
5. Define cost accounting. Describe cost accounting with examples.
6. Write down the step by step procedure for estimating the direct material cost.
7. Explain the estimation of material cost with examples.
8. List down the various items that constitute the overhead expenses.
9. Elaborate the various elements of the cost with suitable examples.
10. What are the various time allowances which should be considered for calculation labour cost.
11. What do you understand by depreciation of a machine? Discuss the various causes of depreciation.
12. Calculate the selling price per unit from the following data : Direct material cost = Rs. 8,000
Direct labour cost = 60 percent of direct material cost
Direct expenses = 5 percent of direct labour cost
Factory expenses = 120 percent of direct labour cost
Administrative expenses = 80 percent direct labour cost
Sales and distribution expenses = 10 percent of direct labour cost
Profit = 8 percent of total cost
No. of pieces produced = 200.
13. A factory is producing 1000 high tensile fasteners per hour on a machine. The material cost is Rs. 375, labour cost is Rs. 245 and direct expense is Rs. 80. The factory oncost is 150 percent of the total labour cost and office oncost is 30 percent of the factory cost. If the selling price of each fastener is Rs. 1.30, calculate whether there is loss or gain and by what amount ?
14. A factory owner employed 50 workers during the month of November 2004, whose detailed expenditure is given below : (i) Material cost = Rs. 30,000 (ii) Rate of wage for each worker = Rs. 6 per hour (iii) Duration of work = 8 hours per day (iv) No. of holidays in the month = 5 (v) Total overhead expenses = Rs. 15,000 If the workers were paid over time of 400 hours at the rate of Rs. 12 per hour, calculate (a) Total cost, and (b) Man hour rate of overheads.
15. An isometric view of a work piece is shown in figure. What will be the weight of the material required to produce it. The density of material is 2.681 gm/cc. Find also the material cost if its rate is Rs.13.60 per kg. All dimensions are in mm.



16. Estimate the weight of material required for manufacturing 220 pieces of shaft as shown in figure. The shafts are made of mild steel which weighs 7.87 gm/cm³ and costs Rs.4.25 per kg. Also calculate the material cost for 220 such shafts.



17. For manufacturing a 'milling machine', the expenditure is tabulated in table.

S.No.	Particulars	Expenses in Rupees
1.	Material consumed	46,000
2.	Indirect factory wages	7,000
3.	Director's fees	2,500
4.	Advertising	8,000
5.	Net profit	11,750
6.	Depreciation on sales department's car	900
7.	Printing and stationery	350
8.	Depreciation on plant	4,200
9.	Direct wages	59,000
10.	Factory rent	5,750
11.	Telephone and postal charges	250
12.	Gas and electricity	400
13.	Office salaries	2,000
14.	Office rent	600
15.	Showroom rent	1,200
16.	Salesman's commission	1,850
17.	Sales department car expenses	1,200

Find out (a) Prime cost, (b) Factory cost, (c) Total cost of production, (d) Cost of sales, and (e) Selling price.

UNIT-IV

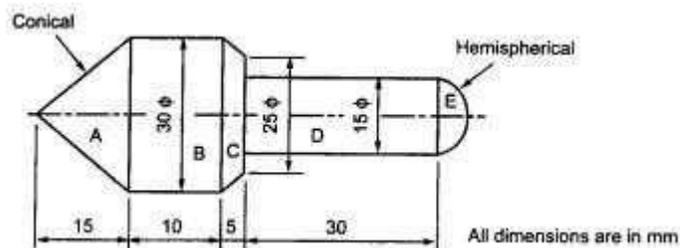
Part-A (2 Marks)

1. What is forging?
2. What are the constituents of a job estimate?
3. What are the components of cost?
4. Name the classification of miscellaneous allowance.
5. Give examples for overhead expenses.
6. What you mean by depreciation?

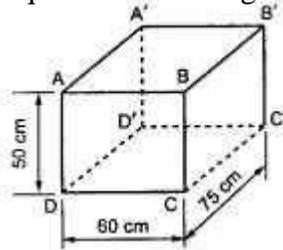
7. What are the losses in forging?
8. State machine hour rate.
9. What is shear loss?
10. What are the elements of forging cost?
11. Name some losses in foundry.
12. Define inadequacy.
13. Define flash loss.
14. What is fatigue allowance?
15. What is meant by direct labour cost?
16. State any four pattern allowance.
17. What are overheads?
18. What are all basis on which overheads are allocated?
19. What are the methods for allocation of overhead expenses?
20. What is administrative overhead?

Part-B (16 Marks)

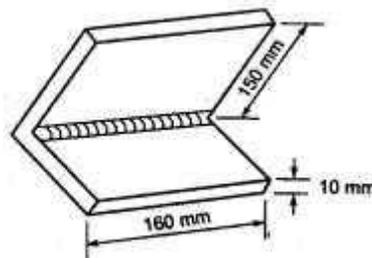
1. Two workers complete 20 connecting rods, each weighing 3.5 kg by forging per day. They are paid at the rate of Rs.16 and Rs.14 per day respectively. If the material cost is Rs.7.25/kg and 60% of the direct labour is required to compensate for the factory overheads, estimate the total cost of each rod.
2. A steel component shown in figure is to be drop forged in close impression dies. Estimate the gross weight of the component. The various losses account for 26 % of net weight. Take density as 7.7 gm/cc. (16)



3. An open water tank of size 75 cm X 60 cm X 50 cm is made by gas welding from a 4 mm thick metallic sheet. Estimate the time required for welding a tank. Neglect other factors.

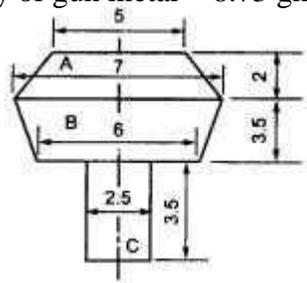


4. Estimate the material cost for welding 2 flat pieces of M.S. 15 X 161 cm size at an angle of 90° by gas welding. Neglect edge preparation cost and assume: Cost O_2 = Rs. 10/m³ Cost of C_2H_2 = Rs. 60/m² Density of filler metal = 7 gm/cc Cost of filler metal = Rs. 12/kg filler rod dia = 5 mm filler rod required 4.5 m/m of welding assume O_2 consumption = 0.7 cu.m/hr. C_2H_2 consumption = 0.5 cu.m/hr. Welding time = 30 min/m of welding. (16)



5. 20 numbers of gun metal bevel gear blank shown in figure are to be cast in the factory from the pattern supplied by the customer. Estimate the selling price of each piece from the following data.

- (i) Cost of molten gun metal = Rs. 9.20 per kg. (3)
- (ii) Scrap return value = Rs. 5.00 per kg. (3)
- (iii) Process scrap = 10 % net weight of casting (3).
- (iv) Administrative overheads = Rs. 3.50 per kg (3).
- (v) Profit = 15% of manufacturing cost. (2)
- (vi) Density of gun metal = 8.73 gm/cc. (2)



6. An engine flywheel is required to be cast according to drawing shown in figure

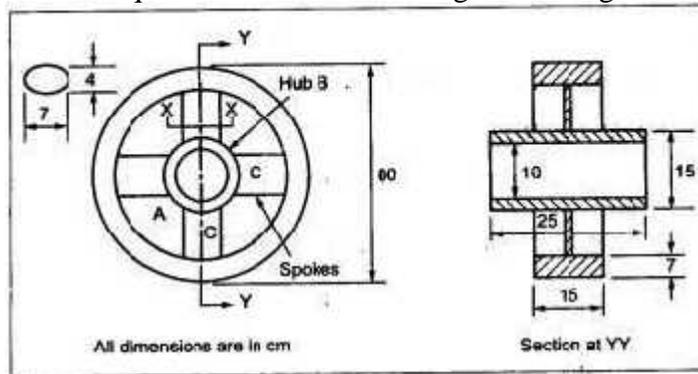


Fig. 10.5.

- (a) Estimate the net weight of the flywheel casting.
- (b) Estimate the selling price of each wheel, given the following data :
- (i) Cost of pattern = Rs. 75 per 500 castings;
 - (ii) Process scrap = 11% of net weight;
 - (iii) Scrap return value = Rs. 0.70 per kg;
 - (iv) Cost of molten metal at furnace spout = Rs. 2 per kg;
 - (v) Administrative overheads = Rs. 6 per hour;
 - (vi) Selling overheads = 25% of production cost;
 - (vii) Profit = 15% of total cost;
 - (viii) Density = 7.2 gm/cc.

Other expenditure detail are :

Unit operation	Time per piece	Labour rate/hour	Shop overheads/hour
Moulding	12 min	Rs. 2.75	Rs. 4.50
Pouring	6 min	Rs. 2.50	Rs. 3.50
Shot blasting	5 min	Rs. 2.60	Rs. 4.00
Fettling	6 min	Rs. 2.40	Rs. 3.25

7. A C.I. factory employees 25 persons It consumes material worth Rs. 35,000 pays workers at the rate of Rs. 5 per hour and incurs total overheads of Rs.20,000. In a particular month (25 days) workers and an overtime of 150 hours and were paid double than the normal rate. Find

- (i) The total cost, and
- (ii) The man hour rate of overheads. Assume 8 hours working days.

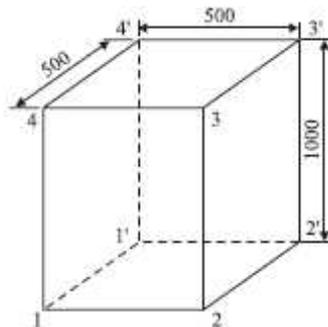
8. What are the various losses considered while calculating the material cost? Explain.

9. What are the elements considered while calculating the cost of welded joints?

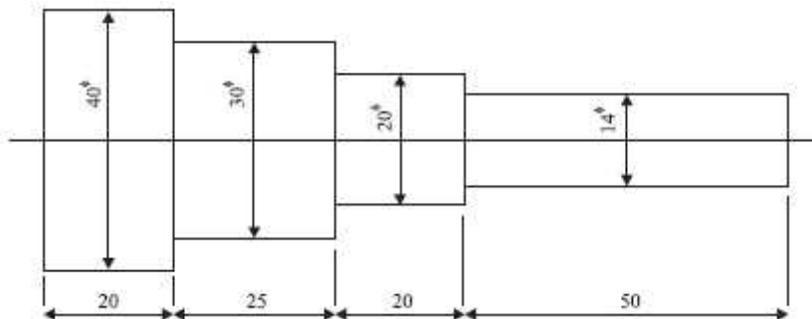
10. Write the step by step procedure to estimate the cost of a cast component in the foundry shop.

11. Under what situations, you can use the allocation of overhead expenses by percentage on prime cost method.

12. A container open on one side of size $0.5 \text{ m} \times 0.5 \text{ m} \times 1 \text{ m}$ is to be fabricated from 6 mm thick plates Fig. The plate metal weighs 8 gms/cc. If the joints are to be welded, make calculations for the cost of container. The relevant data is: Cost of plate = Rs. 10 per kg Sheet metal scarp (wastage) = 5 percent of material Cost of labour = 10 percent of sheet metal cost, Cost of welding material = Rs. 20 per meter of weld.



12. Calculate the net weight and gross weight for the component shown in Fig. Density of material used is 7.86 gm/cc. Also calculate: (i) Length of 14 mm dia bar required to forge one component. (ii) Cost of forging/piece if Material cost = Rs. 80 per kg labour cost = Rs. 5 per piece Overheads = 150 percent of labour cost.



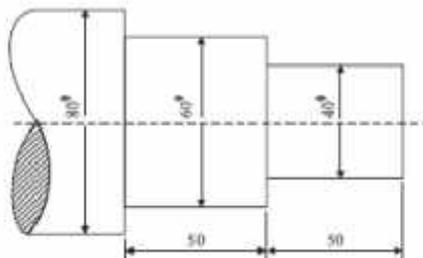
UNIT-V

Part-A (2 Marks)

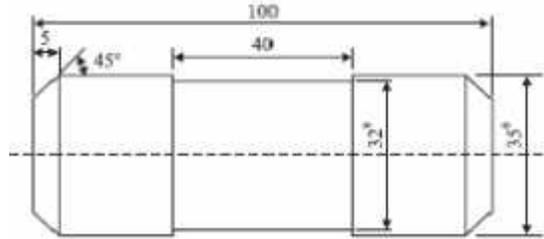
1. What is machining time?
2. Define Length of cut.
3. Define feed.
4. What is meant by turning?
5. Define external relief turning
6. What is meant by chamfering?
7. Define facing.
8. Define knurling
9. Define drilling.
10. What are the various factors to be considered for selection of cutting speed?
11. What is milling? What are the operations that can be carried out on a milling machine?
12. What is grinding? Differentiate between surface and cylindrical grinding.
13. Define tapping.
14. What is meant by Approach length?
15. List the factors to be considered for the selection of feed and depth of cut for a particular operation.
16. Write the equation to calculate the turning time on lathe.
17. How to calculate the machining time calculation for thread operation?
18. How to estimate the milling time?
19. Write the formula for spot milling time.
20. How to estimate the grinding time?

Part-B (16 Marks)

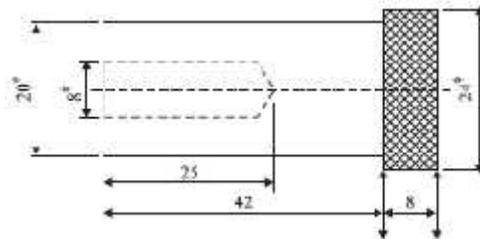
1. Calculate the machining time to turn the dimensions shown in Fig. 5.22. Starting from a m.s. bar of ϕ 80 mm. The cutting speed with HSS tool is 60 meters per minute and feed is 0.70 mm / rev. depth of cut is 2.5 mm per pass.



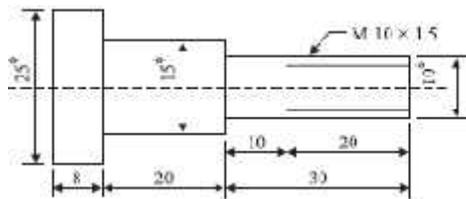
2. A mild steel bar 100 mm long and 38 mm in diameter is turned to 35 mm dia. And was again turned to a diameter of 32 mm over a length of 40 mm as shown in the Fig. 5.23. The bar was machined at both the ends to give a chamfer of $45^\circ \times 5$ mm after facing. Calculate the machining time. Assume cutting speed of 60 m/min and feed 0.4 mm/rev. The depth of cut is not to exceed 3 mm in any operation.



3. A mild steel shaft, shown in Fig. 5.24 is to be turned from a 24 mm diameter bar. The complete machining consists of the following steps: (i) Facing 24 mm f on both sides (ii) Turning to f 20 mm. Process Planning and Cost Estimation (iii) Drilling f 8 mm hole (iv) Knurling. With H.S.S tool the cutting speed is 60 m/min. The feed for longitudinal machining is 0.3 mm/rev. The feed for facing, 0.2 mm/rev., feed for knurling 0.3 mm/rev., and feed for drilling is 0.08 mm/rev. Depth of cut should not exceed 2.5 mm in any operation. Find the machining time to finish the job.



4. Calculate the machining time required to produce one piece of the component shown in Fig. starting from f 25 mm bar. The following data is available. For turning : Cutting speed = 40 m/min. Feed = 0.4 mm/rev. Depth of cut = 2.5 mm/per pass For thread cutting : Cutting speed = 8 m/min.



5. Estimate the time taken to drill a 25 mm dia \times 10 cm deep hole in a casting. First a 10 mm dia drill is used and then the hole is enlarged by a 25 mm dia drill. Assume : Cutting speed = 15 m/min. Feed for f 10 mm drill = 0.22 mm/rev. Feed for f 25 mm drill = 0.35 mm/rev.

6. Calculate the time required to tap a hole with 25 mm diameter tap to a length of 30 mm having 3 threads per cm. The cutting speed is 10 m/min. For return stroke the speed is 2 times the cutting speed.
7. A 300 mm × 50 mm rectangular cast iron piece is to be face milled with a carbide cutter. The cutting speed and feed are 50 m/min and 50 mm/min. If the cutter dia is 80 mm and it has 12 cutting teeth, determine : (i) Cutter r.p.m. (ii) Feed per tooth (iii) Milling time.
8. Find the time required on a shaper to machine a plate 600 mm × 1,200 mm, if the cutting speed is 15 meters/min. The ratio of return stroke time to cutting time is 2 : 3. The clearance at each end is 25 mm along the length and 15 mm on width. Two cuts are required, one roughing cut with cross feed of 2 mm per stroke and one finishing cut with feed of 1 mm per stroke.
9. Mild steel shaft 30 cm long is to be rough ground from 43.3 mm dia to 43 mm dia using a grinding wheel of 40 mm face width. Calculate the time required to grind the job assuming work speed of 12 m/min and depth of cut 0.02 mm per pass.
10. Explain the procedure of estimating the machining cost per piece in machining large number of bolts on a turret lathe.
11. Describe the procedure of estimating the machining time required during shaping
12. How can you estimate the grinding time for a cylindrical grinding operation.

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

Subject : ME6701-POWER PLANT ENGINEERING

Year / Sem :IV/VII

UNIT I COAL BASED THERMAL POWER PLANTS

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

PART-A

CO Mapping : C701.1

Q.No.	Questions	BT Level	Competence	PO
1	What do you understand by the term boiler draught?	BTL-1	Remembering	PO7,PO2
2	Define steam rate and heat rate?	BTL-1	Remembering	PO7,PO2
3	What are the different sources of energy available for power generation? How long they can last?	BTL-1	Remembering	PO7,PO2
4	Why thermal plants are not suitable for supplying fluctuating loads?	BTL-1	Remembering	PO7,PO6
5	List the four important circuits of the steam power plant.	BTL-1	Remembering	PO1,PO7
6	Comment on the thermal efficiency of a steam power plant.	BTL-1	Remembering	PO7,PO10
7	Define the overall efficiency of a steam power plant.	BTL-1	Remembering	PO1,PO7
8	Define air standard cycle efficiency.	BTL-1	Remembering	PO2,PO7
9	State how the steam boilers are classified.	BTL-1	Remembering	PO7,PO8
10	Define boiler mountings and accessories.	BTL-1	Remembering	PO9,PO1
11	Why are super heaters used in steam power plants?	BTL-1	Remembering	PO9,PO4
12	What is the necessity of feed pump in thermal power plant?	BTL-1	Remembering	PO1,PO7
13	Mention the two types of feed water heaters in a steam power plant.	BTL-4	Analysing	PO7
14	What is the function of deaerator in a thermal power plant?	BTL-1	Remembering	PO1

15	Write the use of water level indicator in boiler.	BTL-1	Remembering	PO1
16	What are the accessories used in a boiler?	BTL-1	Remembering	PO1
17	List out the major advantages of high pressure boilers in modern thermal power plants.	BTL-1	Remembering	PO1,PO7
18	Distinguish between fouling and slagging.	BTL-4	Analysing	PO2
19	Define super critical boilers.	BTL-1	Remembering	PO1
20	What is super-critical boiler? Give any two advantages.	BTL-1	Remembering	PO1
21	What are types of fluidized bed boilers?	BTL-1	Remembering	PO1
22	What is meant by compounding of steam turbines?	BTL-1	Remembering	PO1
23	Explain the need of compounding in steam turbines.	BTL-2	Understanding	PO2,PO9
24	What is the function of governors in steam turbine?	BTL-1	Remembering	PO4
25	What are the different methods of governing steam turbines?	BTL-1	Remembering	PO4
26	Enumerate the energy losses in steam turbines.	BTL-1	Remembering	PO2
27	What is the purpose of condenser?	BTL-1	Remembering	PO1
28	Explain any two types of surface condensers.	BTL-2	Understanding	PO1
29	What is a pulverized and why it is used?	BTL-1	Remembering	PO12
30	What is ESP? State its use	BTL-2 BTL-1	Understanding Remembering	PO12
31	Mention the various modern ash handling systems.	BTL-4	Analysing	PO11, PO12
32	What is stoker? Classify it.	BTL-1	Remembering	PO11, PO12

PART-B&PART-C

1	Draw a general layout of steam power plant with neat diagram and explain the working of different circuits.	BTL-1	Remembering	PO1,PO6,PO12
2	Explain the following with neat diagram:(i) Benson boiler (ii) Anyone type of cogeneration power plant.	BTL-1	Remembering	PO1,PO8
3	Draw a general layout of thermal power plant and explain the working of different circuits.	BTL-2	Understanding	PO1,PO6,PO12
4	Describe the working of a high pressure boiler with super heaters.	BTL-2	Understanding	PO1,PO6,PO10
5	Draw a neat diagram of Lamont boiler and explain its working.	BTL-2	Understanding	PO1,PO7, PO12
6	What do you understand by fluidized bed combustion?	BTL-1	Remembering	PO1,PO7, PO12
7	Write short notes on the requirements of surface condensers	BTL-1	Remembering	PO2,PO4, PO11
8	Explain in detail the coal handling system with a suitable block diagram.	BTL-2	Understanding	PO1,PO7, PO12
9	Describe the different types of over feed stokers and discuss its merits and demerits of each over others	BTL-2	Understanding	PO1,PO2, PO9,PO11
10	Why is coal pulverized? Explain any one type of pulverized systems used now-a-days	BTL-2	Understanding	PO1,PO6,PO8

11	With the help of a neat sketch describe the working of any one type of ash handling system	BTL-2	Understanding	PO1,PO7,PO9, PO12
12	Differentiate between forced draught and induced draught cooling tower.	BTL-4	Analysing	PO1,PO2,PO7, PO12

UNIT IIDIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

PART-A

CO Mapping : C701.2

Q.No.	Questions	BT Level	Competence	PO
1	What is reheating and regeneration of gas turbine?	BTL-1	Remembering	PO1,PO7
2	Name the various gas power cycles	BTL-1	Remembering	PO2
3	What is a thermodynamic cycle?	BTL-1	Remembering	PO2
4	Why is Carnot cycle not used in real applications?	BTL-1	Remembering	PO1
5	What is and air-standard cycle? Why such cycles are conceived?	BTL-1	Remembering	PO2
6	Mention the four thermodynamic processes involved in Diesel cycle	BTL-1	Remembering	PO4
7	Mention the various processes of dual cycle.	BTL-1	Remembering	PO2
8	List down the various processes of the Brayton cycle	BTL-1	Remembering	PO2
9	Define Air standard efficiency or Diesel cycle.	BTL-1	Remembering	PO2
10	How does the change in compression ratio affect air standard efficiency of an ideal Otto cycle?	BTL-1	Remembering	PO4
11	Define cut-off ratio	BTL-1	Remembering	PO1
12	Which cycle is more efficient with respect to the same compression ratio?	BTL-1	Remembering	PO2PO8
13	Name the factors that affect air standard efficiency of Diesel cycle.	BTL-1	Remembering	PO1,PO4
14	What is the effect of cut-off ratio on the efficiency of Diesel cycle when the compression ratio is kept constant?	BTL-1	Remembering	PO1,PO4
15	Define the terms actual thermal efficiency and relative efficiency.	BTL-1	Remembering	PO1
16	What is meant by Atkinson cycle?	BTL-1	Remembering	PO1
17	Mention a few characteristics of Diesel power plant.	BTL-1	Remembering	PO7
18	Under what circumstance will you recommend Diesel power plants?	BTL-1	Remembering	PO2,PO12

19	What are the components present in the Diesel electric power plants	BTL-1	Remembering	PO1
20	Name the various types of Diesel engine used for Diesel power plant.	BTL-1	Remembering	PO2
21	What are the different types of engines used in power generation? State their application domain.	BTL-1	Remembering	PO6,PO8,PO10
22	How is solid injection system classified?	BTL-1	Remembering	PO7
23	What are the different types of lubrication system in a Diesel power plant?	BTL-1	Remembering	PO2,PO11,PO12
24	What are the equipment's of Diesel engine power plant?	BTL-1	Remembering	PO1
25	What are the methods used for starting a Diesel engine?	BTL-1	Remembering	PO2,PO9,PO12
26	What is the basic difference between a Diesel engine and a steam turbine?	BTL-1	Remembering	PO6,PO11
27	Why is the maximum cycle temperature of gas turbine plant much lower than that of Diesel power plant?	BTL-1	Remembering	PO2,PO4,PO12
28	State the fuels used in the gas turbine power plants.	BTL-1	Remembering	PO1
29	What are the main units in a gas turbine power plant?	BTL-1	Remembering	PO1
30	What are the methods by which thermal efficiency of a gas turbine power plant be improved?	BTL-1	Remembering	PO4
31	What do you mean by regeneration in gas turbine power plant?	BTL-1	Remembering	PO1
32	How does regeneration improve the thermal efficiency of gas turbine cycle	BTL-1	Remembering	PO2

PART-B&PART-C

1	Discuss the essential components of the diesel power plant with neat layout.	BTL-2	Understanding	PO2,PO4,PO7 PO11,PO12
2	(i) Derive an expression for the work ratio using Brayton cycle. (ii) Discuss the working of any one type of combined cycle power plant.	BTL-6 BTL-2	Creating Understanding	PO2,PO6, PO11,PO8
3	Derive an expression for air the air standard efficiency of diesel cycle. Explain why the efficiency of Otto cycle is more than diesel cycle for the same compression ratio	BTL-6 BTL-2	Creating Understanding	PO4,PO8,PO9, PO11
4	How do you select engine for a diesel power plant? Draw a diesel power plant and explain its major components	BTL-2	Understanding	PO2,PO7, PO12
5	Explain the construction and working of gas turbine power plant with a layout	BTL-2	Understanding	PO1,PO7, PO12
6	Discuss the working of combined cycle power plant.	BTL-2	Understanding	PO9,PO10,PO11

7	With neat diagram, explain the working principle of the combined MHD and steam open cycle power plant.	BTL-2	Understanding	PO1PO7, PO12
8	Discuss the working of combined cycle: power plant.	BTL-2	Understanding	PO2,PO10,PO11,P O12

UNIT IINUCLEAR POWER PLANTS

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR)*, *Pressurized Water Reactor (PWR)*, CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

PART-A

CO Mapping : C701.3

Q.No.	Questions	BT Level	Competence	PO
1	What is critical mass of nuclear fuel?	BTL-1	Remembering	PO1
2	What are isotopes?	BTL-1	Remembering	PO1
3	Name the different types of fuels used in nuclear reactors.	BTL-1	Remembering	PO2,PO7
4	What is known as binding energy?	BTL-1	Remembering	PO1,PO7
5	What is “half life” of nuclear fuels?	BTL-1	Remembering	PO1,PO4
6	What do you mean by mass defect?	BTL-1	Remembering	PO4
7	How can nuclear fussion be caused?	BTL-1	Remembering	PO4
8	What do you understand by moderation?	BTL-1	Remembering	PO2,PO7
9	What is known as moderating ratio?	BTL-1	Remembering	PO1
10	What is four factor formula?	BTL-1	Remembering	PO2
11	Explain the function of nuclear reactor.	BTL-2	Understanding	PO11
12	What are the essential components of a nuclear reactor?	BTL-1	Remembering	PO2
13	Explain the function of the moderator	BTL-2	Understanding	PO2,PO11
14	Name the three moderators commonly used in nuclear power reactor.	BTL-1	Remembering	PO1,PO2
15	Why is shielding of a Nuclear reactor necessary?	BTL-1	Remembering	PO2,PO6
16	Define the term “Breeding”.	BTL-1	Remembering	PO1
17	What is a gas cooled nuclear reactor?	BTL-1	Remembering	PO1
18	What is LMFBR? Why is a liquid metal the preferred coolant in a fast breeder reactor?	BTL-1	Remembering	PO1,PO10,PO12
19	What are the components of pressurized water reactor nuclear power plant?	BTL-1	Remembering	PO1,PO7
20	What are the criteria used for evaluation of nuclear plant safety?	BTL-1	Remembering	PO7,PO11,PO12

21	List some of the disadvantages of Nuclear power plant	BTL-1	Remembering	PO6,PO8,
22	How do you cater for safety of Nuclear power plant?	BTL-1	Remembering	PO6,PO10
23	What are the advantages and disadvantages of breeder reactor?	BTL-1	Remembering	PO11,PO12
24	What factors control the selection of a particular type of a reactor?	BTL-1	Remembering	PO2
25	What are the essential components of a nuclear reactor?	BTL-1	Remembering	PO1
26	What are the conditions to be satisfied to sustain nuclear fission process? OR Give the requirements of chain reaction.	BTL-1	Remembering	PO2
27	How are the nuclear reactors classified?	BTL-1	Remembering	PO8,PO9,PO12
28	Distinguish between PHWR and LMFBR	BTL-4	Analysing	PO9,PO10,PO12
29	State the major reasons for nuclear accidents that classified under moderate frequency.	BTL-1	Remembering	PO6,PO4,PO12
30	State the major reasons for nuclear accidents that classified under severe accidents.	BTL-1	Remembering	PO6,PO4,PO12
31	What are the major reasons for nuclear accidents that classified under lower probability?	BTL-1	Remembering	PO6,PO4,PO12

PART-B & PART-C

Q.No.	Questions	BT Level	Competence	PO
1	(i) Explain CANDU (Canadian-Deuterium-Uranium) reactor with neat diagram also mention its merits and demerits. (ii) Discuss about the safety measures adopted in modern nuclear plants.	BTL-2	Understanding	PO2,PO6,PO4, PO10,PO12
2	What is meant by uranium enriched? Describe some methods of Uranium enrichment	BTL-1	Remembering	PO1,PO4,PO9,PO11
3	Explain the Construction and working of nuclear power plant with a layout.	BTL-2	Understanding	PO1,PO9,PO12
4	Explain the different types of nuclear reactions and initiation of nuclear reactions	BTL-2	Understanding	PO1,PO7,PO12
5	Explain with a neat sketch a boiling water reactor.	BTL-2	Understanding	PO1,PO7,PO10
6	Explain the working of pressurized water reactor	BTL-2	Understanding	PO1,PO7,PO10
7	What is chain reaction? How it is maintained? What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples'	BTL-2 BTL-4	Understanding Analysing	PO1,PO7,PO10
8	Discuss the various factors to be considered while	BTL-2	Understanding	

selecting the site for nuclear power station.			
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UNIT IV POWER FROM RENEWABLE ENERGY

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

PART-A

CO Mapping : C701.4

Q.No.	Questions	BT Level	Competence	PO
1	Define the term “Hydrology”.	BTL-1	Remembering	PO1
2	What is hydrograph?	BTL-1	Remembering	PO1
3	For which purposes hydro projects are developed?	BTL-1	Remembering	PO2,PO7
4	What is the purpose of using dams?	BTL-1	Remembering	PO6,PO7
5	Define Run-off.	BTL-1	Remembering	PO1
6	Classify power plants on the basis of traditional use.	BTL-2	Understanding	PO2,PO11
7	List out the important parameters of a turbine.	BTL-1	Remembering	PO1
8	Give an example for a low head turbine, a medium head turbine and a high head turbine.	BTL-1	Remembering	PO2
9	What are reaction turbines? Give examples.	BTL-1	Remembering	PO2
10	What is a draft turbine?	BTL-1	Remembering	PO1
11	What is the function of draft tube?	BTL-1	Remembering	PO1
12	What are the different types of spill ways?	BTL-1	Remembering	PO1,PO7, PO10
13	Define unit speed of turbine.	BTL-1	Remembering	PO1
14	What is the significance of specific speed of hydraulic turbines?	BTL-1	Remembering	PO1
15	What is a surge tank?	BTL-1	Remembering	PO1
16	What is draft tube? In which type of turbine it is mostly used?	BTL-1	Remembering	PO1, PO7
17	What is the necessity of draft tubes? List the types	BTL-1	Remembering	PO9, PO10
18	Write the function of draft tube in turbine outlet.	BTL-1	Remembering	PO2
19	What are the factors to be considered in selecting turbines?	BTL-1	Remembering	PO1,PO7
20	On what basis hydraulic turbines are selected?	BTL-1	Remembering	PO2,PO6,PO8
21	What do you understand by zero energy houses?	BTL-1	Remembering	PO6,PO7,PO11
22	List any four advantages of wind turbine.	BTL-1	Remembering	PO7,PO12
23	What are the advantages of pumped storage plant?	BTL-1	Remembering	PO8,PO12

24	What is the purpose of flywheel which is used in an IC engine?	BTL-1	Remembering	PO6,PO7,PO9 PO10
25	What is the function of flywheel?	BTL-1	Remembering	PO1,PO7, PO12
26	What are the components of tidal power plants?	BTL-1	Remembering	PO1,PO7
27	What are the different methods of producing electricity with tides?	BTL-1	Remembering	PO1,PO4,PO10,PO12
28	What is a solar cell?	BTL-1	Remembering	PO1
29	What are the classifications of geothermal energy?	BTL-1	Remembering	PO2,PO6,PO7
30	What are the types of geothermal power plants?	BTL-1	Remembering	PO2,PO6,PO7
31	What is bio gas? Give the advantages.	BTL-1	Remembering	PO1,PO7,PO12
32	List the difference between Francis and Kaplan turbine	BTL-1	Remembering	PO2,PO8

PART-B& PART-C

1	What are the essential elements of hydro power plant? Explain with a neat sketch.	BTL-2	Understanding	PO1,PO6,PO7,PO12
2	Explain the working of Pelton turbine with a neat diagram. What is the function of a draft tube?	BTL-2	Understanding	PO1,PO6,PO7,PO12
3	Describe the working of a low head hydro plant with a neat diagram	BTL-2	Understanding	PO1,PO6,PO7,PO12
4	Compare and contrast Kaplan turbine and Francis turbine.	BTL-4	Analyzing	PO1,PO2,PO7, PO10
5	Discuss various components of wind energy system	BTL-2	Understanding	PO1,PO9, PO10,PO12
6	Explain with a neat sketch a pumped storage power plant.	BTL-2	Understanding	PO1,PO7,PO12
7	Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
8	Draw a schematic diagram of a solar power plant and explain the operation of it. Also mention its merits and demerits.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
9	Explain the construction and working of geothermal power plant and tidal power plants.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
10	Define the terms anaerobic digestion, Fermentation and What are the advantages and disadvantages of floating drum plant Give the list of the materials used for biogas generation.	BTL-1	Remembering	PO1,PO7,PO8,PO10, PO12
11	Describe the principle of a fuel cell and discuss the choice of fuels required	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
12	(i) Explain the construction and working of fuel cell also mention its merits and demerits. (ii) List the advantages and disadvantages of wind	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12

	energy system.			
13	Explain with a neat sketch working of a distributed (Parabolic) trough Solar Power Plant.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12

UNIT VENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

PART-A

CO Mapping : C701.5

Q.No.	Questions	BT Level	Competence	PO
1	What is main objective of tariff?	BTL-1	Remembering	PO1
2	Define law of conservation of Energy.	BTL-1	Remembering	PO1
3	What is the significance of incremental rate for a power plant	BTL-1	Remembering	PO2,PO6
4	What are the various operating costs of fired steam power plant?	BTL-1	Remembering	PO6,PO10,PO11
5	Define demand for electricity	BTL-1	Remembering	PO6,PO7,PO12
6	Define "Diversity factor".	BTL-1	Remembering	PO1
7	Define plant use factor	BTL-1	Remembering	PO1
8	What are the major factors that Decide the economics of power plants?	BTL-1	Remembering	PO1,PO6,PO7,PO11
9	What do you understand by load duration curves?	BTL-1	Remembering	PO2
10	State the importance of load curves.	BTL-1	Remembering	PO1
11	What is the significance of load curve?	BTL-1	Remembering	PO1
12	What is the use of load curves in power plant?	BTL-1	Remembering	PO1,PO8
13	How does the fuel cost related to the load and the cost of power generation?	BTL-1	Remembering	PO6,PO11
14	What are fixed?	BTL-1	Remembering	PO1
15	Define flat rate tariff.	BTL-1	Remembering	PO1
16	List the types of tariffs to calculate energy rate.	BTL-1	Remembering	PO1
17	How the tariff for electrical energy is arrived?	BTL-1	Remembering	PO2,PO10
18	Define depreciation.	BTL-1	Remembering	PO1
19	Mention any four methods for calculating depreciation.	BTL-1	Remembering	PO7,PO11,PO12
20	What is the reason for the operating cost of hydel power plant being high?	BTL-1	Remembering	PO2,PO8,PO9,PO10
21	How can be the cost of power generation reduced?	BTL-1	Remembering	PO9,PO11,PO12
22	What are the factors that contribute for energy cost?	BTL-1	Remembering	PO1,PO8,PO11
23	List out four important factors to be considered for the selection of site for power plants.	BTL-1	Remembering	PO4,PO11,PO12
24	What are the different pollutions in the flue gas?	BTL-1	Remembering	PO7
25	What are the methods used for reduction of SO ₂ pollutant?	BTL-1	Remembering	PO1,PO7
26	What are the methods used for controlling the NO _x ?	BTL-1	Remembering	PO2,PO8,PO12

27	What is Acid rain?	BTL-1	Remembering	PO7
28	What is the equipment used to control the particulates?	BTL-1	Remembering	PO1,PO6,PO12
29	List down the nuclear waste disposal methods.	BTL-1	Remembering	PO1,PO6,PO7,PO12
30	What are the various methods followed to transport solid waste?	BTL-1	Remembering	PO1,PO6,PO7,PO12
31	What are operating costs?	BTL-1	Remembering	PO1,PO9,PO11
32	What are the costs involved in fired steam power plant?	BTL-1	Remembering	PO1,PO11
PART-B& PART-C				
1	Explain the methods to control pollution in thermal and nuclear power plants	BTL-2	Understanding	PO7,PO8
2	Write an explanatory note on the economics of power generation	BTL-2	Understanding	PO8,PO10,PO11
3	What is meant by load factor and diversity factor?	BTL-1	Remembering	PO1,PO2
4	Elucidate the objectives and requirements to tariff and general form of tariff.	BTL-2	Understanding	PO4,PO9,PO11
5	What are the elements which contribute to the cost of, the electricity? And how can the cost power generation be reduced?	BTL-1	Remembering	PO6,PO8,PO9,PO11
6	Explain briefly the various methods used to, calculate the depreciation cost.	BTL-2	Understanding	PO1,PO8,PO10,PO11
7	What are the fixed and operating costs of steam power plant?How are they accounted for fixing cost of electricity?	BTL-1	Remembering	PO1,PO8,PO10,PO11
8	Explain the analysis of pollution from thermal power plants.What is methods used for control the pollutants?	BTL-2	Understanding	PO1,PO7,PO10,PO12
9	Write short notes on nuclear waste disposal.	BTL-1	Remembering	PO1,PO7,PO8,PO10, PO12
10	(i) Explain the site selection criterion of hydro power plant. (ii)A peak load on the thermal power plant is 75 MW. The loads having maximum demands of 35 kW, 20 MW, 15 MW and 18 MW are connected to the power plant. The capacity of the plant is 90 MW and annual load factor is 0.53. Calculate the average load on power plant, energy supplied per year, demand factor and diversity factor.	BTL-2	Understanding	PO1,PO2,PO4, PO7,PO12

UNIT ICOAL BASED THERMAL POWER PLANTS

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

PART-A

1. What do you understand by the term boiler draught? (AU Nov/Dec 2016)

Boiler draught may be defined as the small difference between the pressure of outside air and that of gases within a furnace or chimney at the grate level, which causes flow of air/hot flue

gases to take place through boiler.

2. Define steam rate and heat rate? (AU Nov/Dec 2016)

Heat rate is the common measure of system efficiency in a steam power plant. It is defined as "the energy input to a system, typically in Btu/kWh, divided by the electricity generated, in kW." Mathematically:

$$\text{Heat Rate (BTU/kWh)} = \frac{\text{Input Energy (BTU/hr)}}{\text{Output Power (kW)}}$$

Steam rate: It is defined as the rate of steam flow (kg/hr) required for producing unit shaft output (1 kW)

3. What are the different sources of energy available for power generation? How long they can last? (AU May 2014)

1. Steam
2. Gas or air
3. Diesel and petrol
4. Nuclear
5. Renewable energy sources such as solar, wind, geothermal, tidal, wave, MHD etc

4. Why thermal plants are not suitable for supplying fluctuating loads?

(AU (EEE) May 2014)

Thermal plants are not suitable for supplying fluctuating loads because any change in load demand requires the corresponding change in the output energy. In thermal power plants, the input energy is produced by burning the coal. So, there is always a large time lapse between the change in energy output and input which is not desirable. Therefore, such power stations are used only as base load stations and it supplies the constant power.

5. List the four important circuits of the steam power plant.

(AU (MECH) DEC 2014 & (EEE) DEC 2013)

- a. Feed water and steam flow circuit
- b. Coal and ash circuit
- c. Air and gas circuit
- d. Cooling water circuit

6. Comment on the thermal efficiency of a steam power plant. (AU.(EEE)DEC'12)

Thermal efficiency is a dimensionless performance which is a measure of a device using thermal energy such as internal combustion engine, steam turbine or steam engine, boiler and furnace or refrigerator.

7. Define the overall efficiency of a steam power plant. (AU.(EEE) DEC'10)

Overall efficiency is defined as the combined efficiency of boiler, steam turbine, condenser and pump

8. Define air standard cycle efficiency. (AU.(MECH)DEC'13)

It is the ratio of work done during the process to the heat supplied.

Air Standard efficiency = Work done/Heat supplied.

Where Work done = Heat supplied - Heat rejected.

9. State how the steam boilers are classified. (AU.(MECH)DEC'14)

Steam boilers are classified on the basis of boiler pressure, fuel, boiler material, boiler tube type, circulation, method of combustion, type of support, furnace construction, furnace position, use, erection, mobility, ASME code and heat source.

10. Define boiler mountings and accessories. (AU.(EEE)May'11)

The devices which are used for functioning with the safe operation of a boiler are called boiler mountings. The devices which are used to increase the efficiency of the boiler are called boiler accessories.

11. Why are super heaters used in steam power plants? (AU.(EEE) DEC'12)

The steam produced in the boiler is in the state of saturated condition. The moisture in the steam will

<p>affect turbine blades and cause corrosion. To avoid it, the super heater is used. It is used to increase the temperature of steam and improve the efficiency.</p>
<p>12. What is the necessity of feed pump in thermal power plant?(AU.(EEE)DEC'11) Feed pump is a pump which is used to deliver the feed water to the boiler. The quantity of water supplied should be at least equal to the amount of evaporation which is supplied to the engine.</p>
<p>13. Mention the two types of feed water heaters in a steam power plant. (AU (EEE)DEC'10)</p> <p>(i) Open feed water heater. (ii) Closed feed water heater.</p>
<p>14. What is the function of deaerator in a thermal power plant?(AU.(EEE)May'12) A deaerator is a device widely used for the removal of air and other dissolved gases from the feed.</p>
<p>15. Write the use of water level indicator in boiler. (AU.(EEE)DEC'13) The water level indicator constantly determines the level of water in the boiler shell.</p>
<p>16. What are the accessories used in a boiler?(AU.(MECH)May'13)</p> <p>(i) Feed water pump (ii) Injector (iii) Pressure reducing valve (iv) Economiser (v) Air pre heater (vi) Super heater (vii) Steam drier or separator (viii) Steam trap.</p>
<p>17. List out the major advantages of high pressure boilers in modern thermal power plants. (AU.(MECH)DEC '12 & DEC'13)</p> <ul style="list-style-type: none"> • The tendency of scale formation is eliminated due to high velocity of water through tubes. • Light weight tubes with better heating surface arrangement can be used. The space required is less. The cost foundation, time of erection and total cost are minimised due to less weight of tubes. • Due to use of forced circulation, there is more freedom in the arrangement of surface, tubes and boiler components. • All parts are uniformly heated. So, the danger of overheating is reduced and thermal stress problem is eliminated.
<p>18. Distinguish between fouling and slagging. (AU.(MECH) May'09) Slagging is the formation of molten or partially fused deposits on furnace walls or convection surfaces exposed to radiant heat. Fouling is defined as the formation of deposit on convection heat surfaces such as super heater and reheater.</p>
<p>19. Define super critical boilers. (AU.(MECH) Nov'07) Boilers only with economizer and super heater are called super critical boilers.</p>
<p>20. What is super-critical boiler? Give any two advantages.(AU.(EEE) June'13) If boilers incorporate only economizer and super heater, they are called supercritical boilers. The super critical boilers are above 300MW capacity units available.</p>
<p>21. What are types of fluidized bed boilers? (AU.(MECH)DEC'13)</p> <p>1. Bubbling fluidized bed boilers(BFB). 2. Circulating fluidized bed boilers (CFB).</p>
<p>22. What is meant by compounding of steam turbines? (AU.Nov'10) Compounding is a method of absorbing the jet velocity in stages when the steam flows over moving blades.</p>
<p>23. Explain the need of compounding in steam turbines. (AU (MECH)Apr'03 & Apr'08)</p>

In the simple impulse turbine, the expansion of steam from the boiler pressure to condenser pressure takes place in a single stage turbine. The velocity of steam at the exit of turbine is very high. So, there is a considerable loss of kinetic energy. Also, the speed of the rotor is very high. There are several methods of reducing this speed to a lower value. Compounding is a method of absorbing the jet velocity in stages when the steam flows over moving blades.

24. What is the function of governors in steam turbine?(AU.(MECH)DEC'08)

The governors regulate the supply of steam to the turbine to maintain constant speed of the turbine as far as possible under varying load conditions.

25. What are the different methods of governing steam turbines?

(AU(MECH)Nov'04 & May'13)

- Throttle governing
- Nozzle control governing
- By pass governing
- Combination of throttle and nozzle governing or throttle and by pass governing.

26. Enumerate the energy losses in steam turbines.

(AU(MECH)June'09,May'11 & May'12)

- Losses in regulating valves
- Losses due to steam friction
- Losses due to Mechanical friction
- Losses due to leakage
- Residual velocity losses
- Carry over losses
- Losses due to wetness of steam
- Losses due to radiation.

27. What is the purpose of condenser?

(AU.(EEE)DEC'10)

The main purpose of a steam condenser in turbine is to maintain a low back pressure on the exhaust side of the steam turbine.

28. Explain any two types of surface condensers.

(AU.(MECH)May'14)

- (i) Down flow type
- (ii) Central flow condenser
- (iii)Evaporation condenser

29. What is a pulverized and why it is used? (AU.(MECH)May '14 &(EEE) DEC'14)

A pulverize or grinder is a Mechanical device for grinding many different types of materials.Pulverize mill is used to pulverize the coal for combustion in the steam generating furnaces of fossil fuel power plants.

30. What is ESP? State its use.(Anna .Univ.(MECH)DEC'14)

An electrostatic precipitator (ESP) is a filtration device which is used to remove fine particles such as dust and smoke from a flowing gas using the force of an induced electrostatic charge minimally impeding the flow of gases through the unit.

31. Mention the various modern ash handling systems.(AU (EEE)May'10)

- i. Gravitational separator
- ii. Cyclone separator
- iii. Packed type scrubber
- iv. Spray type wet collector
- v. Electrostatic precipitator(ESP)

32. What is stoker?Classify it.

(AU.(MECH)May'11)

Stoker is a feeding device which feeds solid fuels into the furnace in medium and large size power plants.

Types: (i) Overfeed stoker, and (ii) Underfeed stoker
PART-B
1. Draw a general layout of steam power plant with neat diagram and explain the working of different circuits. [AU Nov/Dec 2016] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
2. Explain the following with neat diagram:(i) Benson boiler (ii) Anyone type of cogeneration power plant. [AU Nov/Dec 2016] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
3. Draw a general layout of thermal power plant and explain the working of different circuits. [AU APR 2005/MAY 2011/2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
4. Describe the working of a high pressure boiler with super heaters. [AU MAY 2011] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
5. Draw a neat diagram of Lamont boiler and explain its working. [AU DEC 2005/JULY2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
6. What do you understand by fluidized bed combustion? [AU MAY 2012] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
7. Write short notes on the requirements of surface condensers .[AU MAY 2009] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
8. Explain in detail the coal handling system with a suitable block diagram. [AU MAY 2011] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
9. Describe the different types of over feed stokers and discuss its merits and demerits of each over others. [AU APR 2008] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
10. Why is coal pulverized? Explain any one type of pulverized systems used now-a-days. [AU MAY 2012] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
11. With the help of a neat sketch describe the working of any one type of ash handling system. <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
12. Differentiate between forced draught and induced draught cooling tower. [AU MAY 2009/DEC 2012] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>

UNIT IIDIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS
Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.
PART-A
1. What is reheating and regeneration of gas turbine? [AU Nov/Dec 2016] Reheating is applied in a gas turbine in such a way that it increases the turbine work without increasing

the compressor work or melting the turbine materials. When a gas turbine plant has a high pressure and low pressure turbine a reheater can be applied successfully. Reheating can improve the efficiency up to 3 %. A reheater is generally is a combustor which reheat the flow between the high and low pressure turbines.

Regeneration process involves the installation of a heat exchanger in the gas turbine cycle. The heat-exchanger is also known as the recuperator. This heat exchanger is used to extract the heat from the exhaust gas. This exhaust gas is used to heat the compressed air. This compressed and pre-heated air then enters the combustors. Regenerated Gas turbines can improve the efficiency more than 5 %.

2. Name the various gas power cycles. [AU Nov/Dec 2016]

Otto Cycle, Diesel Cycle, Dual Cycle & Brayton Cycle.

3. What is a thermodynamic cycle?

(AU.Oct'97)

Thermodynamic cycle is defined as the series of processes performed on the system so that the system attains its original state.

4. Why is Carnot cycle not used in real applications?

(AU.DEC'10)

- i. In a Carnot cycle, all four processes are reversible but there is no process reversible in actual practice.
- ii. There are two processes to be carried out during compression and expansion. During isothermal process, the piston moves very slowly and the piston moves as fast as possible during adiabatic process. This speed variation during the same stroke of the piston is not possible.
- iii. It is not possible to avoid friction between moving parts completely.

5. What is and air-standard cycle? Why such cycles are conceived?

(AU.Oct'96, Oct'97, Nov'10, May'11, DEC'12 & May'14)

Cycle is defined as the series of operations or processes performed on a system so that the system attains its original state. The thermodynamic cycles which use air as the working fluid are known as air standard cycles. Air standard cycles are conceived to simplify the analysis of IC engines.

6. Mention the four thermodynamic processes involved in Diesel cycle. (AU.Apr'08)

- i. One reversible adiabatic compression
- ii. One constant pressure processes
- iii. One reversible adiabatic expansion and
- iv. One constant volume.

7. Mention the various processes of dual cycle.

(AnnaUniv.Apr'96)

1. Isentropic compression
2. Constant volume heat addition
3. Constant pressure heat addition
4. Isentropic expansion and
5. Constant volume heat rejection.

8. List down the various processes of the Brayton cycle.

(AU.Oct'96)

1. Isentropic compression
2. Constant pressure heat supplied
3. Isentropic expansion and
4. Constant pressure heat rejection.

9. Define Air standard efficiency or Diesel cycle.

(AU.DEC'08)

Air standard efficiency is defined as the ratio of work done by the cycle to the heat supplied to the cycle

10. How does the change in compression ratio affect air standard efficiency of an ideal Otto cycle?

(AU.Apr.'08)

The efficiency of otto cycle increases with increase in compression ratio and vice versa.

11. Define cut-off ratio.

(AU.May'14)

Cut off ratio is defined as the ratio of volume after heat addition to the volume before heat addition.

<p>12. Which cycle is more efficient with respect to the same compression ratio? (AU.Oct'95) For the same compression ratio, Otto cycle is more efficient than Diesel cycle.</p>
<p>13. Name the factors that affect air standard efficiency of Diesel cycle. (AU.Apr'97) Compression ratio and Cut-off ratio.</p>
<p>14. What is the effect of cut-off ratio on the efficiency of Diesel cycle when the compression ratio is kept constant? (AU.Apr'03) When the cut-off ratio of Diesel cycle increases, the efficiency of cycle is decreased when the compression ratio is kept constant and vice versa.</p>
<p>15. Define the terms actual thermal efficiency and relative efficiency. (AU.DEC'12) Actual efficiency is defined as the ratio of work output by the cycle to the heat input to the cycle. Relative efficiency is defined as the ratio between actual efficiency and air standard efficiency.</p>
<p>16. What is meant by Atkinson cycle? (AU.(MECH)DEC'12) The cycle with two adiabatic processes for both compression and expansion, one constant volume process for heat addition and one constant pressure process for heat rejection is called Atkinson cycle.</p>
<p>17. Mention a few characteristics of Diesel power plant. (AU.(MECH) DEC'12)</p> <ol style="list-style-type: none"> Diesel power plants are mainly used where high torque is required. Fuel and fluid characteristics mean that Diesel power plant could be operated with variety of different fuels depending on configuration. Hybrid possibilities are to combine with other power producing devices.
<p>18. Under what circumstance will you recommend Diesel power plants? (AU.(MECH)DEC'14) Diesel power plants are mainly recommended where the fuel prices or reliability of supply favor oil over coal where the water supply is limited and relatively small loads.</p>
<p>19. What are the components present in the Diesel electric power plants? (AU.(MECH)Apr'08)</p> <ol style="list-style-type: none"> Engine Air intake system Engine starting system Fuel system Exhaust system Cooling system Lubricating system
<p>20. Name the various types of Diesel engine used for Diesel power plant. (AU.(MECH) May'13)</p> <ol style="list-style-type: none"> Small size Diesel engine. Medium size Diesel engine Large size Diesel engine.
<p>21. What are the different types of engines used in power generation? State their application domain. (Anna .Univ.(MECH)May'11)</p> <ol style="list-style-type: none"> Diesel engines Dual engines
<p>22. How is solid injection system classified? (AU.(EEE)June'13)</p> <ol style="list-style-type: none"> Individual pump and nozzle system Unit injector system Common rail system Distributor system.
<p>23. What are the different types of lubrication system in a Diesel power plant? (AU.(MECH)May'14)</p> <ol style="list-style-type: none"> Wet sump lubrication Dry sump lubrication Mist lubrication system

<p>24. What are equipment's of Diesel engine power plant? (AU.(MECH)Nov'07)</p> <ol style="list-style-type: none"> 1. Pneumatic starter 2. Air compressor 3. Air-conditioning and 4. Coolant circulation pump.
<p>25. What are the methods used for starting a Diesel engine?(AU.(MECH)Nov'07)</p> <ol style="list-style-type: none"> 1. Starting by an auxiliary engine 2. Use of electric motors or starters 3. Compressed air system
<p>26. What is the basic difference between a Diesel engine and a steam turbine? (AU.(EEE)DEC'12)</p> <p>The basic difference is that Diesel engine is internal combustion (IC) engine whereas the steam turbine is external combustion engine.</p>
<p>27. Why is the maximum cycle temperature of gas turbine plant much lower than that of Diesel power plant? (AU(MECH)May'09)</p> <p>Air alone is combusted in gas turbine plant instead of air-Diesel combustion in the Diesel power plant.</p>
<p>28. State the fuels used in the gas turbine power plants. (AU.(EEE)May'11)</p> <p>Residual liquid fuels, the residue left after the profitable light fractions have been extracted from the crude have been used in gas turbines to some extent.</p>
<p>29. What are the main units in a gas turbine power plant? (AU (MECH)DEC'13 & (EEE) DEC'11)</p> <ol style="list-style-type: none"> 1. Compressor 2. Combustion chamber 3. Turbine
<p>30. What are the methods by which thermal efficiency of a gas turbine power plant be improved? (AU.(EEE)May'12 & DEC'12)</p> <ol style="list-style-type: none"> 1. Intercooling 2. Reheating 3. Regenerator 4. Combination of intercooling reheating and regenerator.
<p>31. What do you mean by regeneration in gas turbine power plant?(AU.(EEE)June'13)</p> <p>The partial bleeding of steam from the turbine to preheat the air to reduce the fuel consumption and increase the efficiency is called regeneration.</p>
<p>32. How does regeneration improve the thermal efficiency of gas turbine cycle? (AU.(MECH)DEC'14)</p> <p>Regeneration reduces the energy requirement from the fuel thereby increasing the efficiency of the cycle.</p>
<p>PART-B& PART-C</p>
<p>1. Discuss the essential components of the diesel power plant with neat layout. [AU Nov/Dec 2016]</p> <p><i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>2. (i) Derive an expression for the work ratio using Brayton cycle. (ii)Discuss the working of any one type of combined cycle power plant. [AU Nov/Dec 2016]</p> <p><i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>3. Derive an expression for air the air standard efficiency of diesel cycle. Explain why the efficiency of Otto cycle is more than diesel cycle for the same compression ratio. [AU NOV 2010/MAY2014]</p>

<i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>	
4.	How do you select engine for a diesel power plant? Draw a diesel power plant and explain its major components [AU MAY 2014] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
5.	Explain the construction and working of gas turbine power plant with a layout [AU DEC 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
6.	Discuss the working of combined cycle power plant [AU MAY 2011/MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
7.	With neat diagram, explain the working principle of the combined MHD and steam open cycle power plant. [AU NOV 2008] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
8.	Discuss the working of combined cycle: power plant.[AU MAY 2011/MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>

UNIT III NUCLEAR POWER PLANTS

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.*

PART-A

1.	What is critical mass of nuclear fuel? [AU Nov/Dec 2016] A critical mass is the smallest amount of fissile material needed for a sustained nuclear chain reaction
2.	What are isotopes? (AU.(EEE)DEC'13) Some elements exist in different forms. Mass number of these forms is different but the atomic number is the same. They are known as isotopes of the element.
3.	Name the different types of fuels used in nuclear reactors. (AU.(EEE)DEC'12) Uranium, Plutonium and Thorium.
4.	What is known as binding energy? (AU.(EEE) DEC'11) The energy released at the moment of combination of two nucleons to form nucleus of an atom is called "binding energy".
5.	What is "half life" of nuclear fuels? (AU.(MECH) Nov'08) The radioactive half-life for a given radioisotope is a measure of the tendency of nucleus to "DECAY" or "disintegrate" and it is based purely upon that probability.
6.	What do you mean by mass defect? (AU.(EEE) June'13) During the interaction two or more particles to combine together, the total mass of the system will decrease and it will be less than the sum of the masses of the individual particles. The stronger the interaction becomes and more the mass will decrease. It decrease the mass of the system called mass defect.
7.	What is nuclear fission? (AU.(MECH) May'11,(EEE) May'11 & May'12) or How can nuclear fission be caused? (AU. (EEE)DEC'10) Nuclear fission is the process of splitting the nucleus into two almost equal fragments accompanied by the release of heat. In other words, it is the process of splitting the unstable heavy nucleus into two fragments of approximately equal mass when bombarded with neutrons.
8.	What do you understand by moderation? (AU.DEC'04)

The process of slowing down the speed of neutrons from high velocity without capturing them is known as moderation	
9. What is known as moderating ratio?	(AU.(EEE) DEC'10)
Multiplication ratio or reproduction factor of the system is defined as the number of neutron in any particular generation in total number of neutrons in the preceding generation. $K = \frac{\text{Number of neutrons in any particular generation}}{\text{Number of neutrons in the preceding generation}}$	
10. What is four factor formula?	(AU.(EEE) DEC'10)
The four-factor formula is also known as Fermi's four factor formula used in nuclear engineering to determine the multiplication of a nuclear chain reaction in an infinite medium.	
11. Explain the function of nuclear reactor.	(AU.(MECH)Apr'08 & May'11)
A nuclear reactor is similar to the furnace of a steam power plant or combustion chamber of a gas turbine plant. In the nuclear reactor, heat is produced due to nuclear fission chain reaction.	
12. What are the essential components of a nuclear reactor?	(AU.(EEE) May'10)
<ul style="list-style-type: none"> • Reactor core • Moderator • Control rods • Reflector • Cooling system • Reactor vessel • Biological shielding. 	
13. Explain the function of the moderator.	(AU(MECH) May'07 & May '11 & (EEE)DEC'12)
Moderator is a material which is used to slow down the neutrons from high velocities without capturing them. The fast moving neutrons are far less effective in causing the fission and for the escape from the reactor.	
14. Name the three moderators commonly used in nuclear power reactor.	(AU.(EEE)May'12)
Heavy water (D ₂ O), water (H ₂ O), Beryllium(Be), Graphite (G) and Helium(He) gas are commonly used moderators	
15. Why is shielding of a Nuclear reactor necessary?	(AU.(MECH)May'13) [AU Nov/Dec 2016]
Shielding is necessary to protect walls of the reactor vessels from radiation damage and it also protect the operating personnel from exposure to radiation. Thick layers of lead concrete or steel are provided all around the reactor. These layers absorb the gamma rays, neutrons etc.	
16. Define the term "Breeding".	(AU.Apr'05)
In a fast breeder reactor, the process of producing energy to self-sustain the nuclear fission chain reaction without using moderator is known as breeding. Enriched Uranium(U ²³⁵) or Plutonium is used as fuels which are surrounded by a thick blanket of fertile Uranium(U ²³⁸).	
17. What is a gas cooled nuclear reactor?	(AU.(MECH)DEC'14)
A Gas such as carbon dioxide is used to carry away the heat produced due to nuclear fission in the reactor. For example, the gas cooled reactor is with CO ₂ gas as coolant and graphite as moderator.	
18. What is LMFBR? Why is a liquid metal the preferred coolant in a fast breeder reactor?	(AU.(EEE)June'13)
LMFBR stands for Liquid Metal Fast Breeder Reactor. The liquid metal is always preferred as the coolant since it is an excellent heat transfer material. Ex: Sodium and Potassium.	
19. What are the components of pressurized water reactor nuclear power plant?	(AU.DEC'05)
<ul style="list-style-type: none"> • Reactor • Pressuriser 	

- Heat exchanger
- Coolant pump

20. What are the criteria used for evaluation of nuclear plant safety?(AU.Nov'07)

- There is no unreasonable risk.
- It has adequate protection of public health and safety.
- Risk is reasonably low.
- Safety is as high as reasonably achievable.
- It limits the risk by use of best technologies at acceptable economic costs.

21. List some of the disadvantages of Nuclear power plant.(AU.(EEE)DEC'10)

- Similar to fossil fuels, nuclear fuels are nonrenewable energy resources.
- If the accident occurs, large amount of radioactive material could be released into the environment.
- Nuclear waste also remains radioactive and it is hazardous to health for thousands of years.

22. How do you cater for safety of Nuclear power plant? (AU.(MECH)May'14)

Nuclear safety and security cover the actions taken to prevent nuclear and radiation accidents or to limit their consequences. The main safety concern is the emission of uncontrolled radiation into the environment which could cause harm to human both at the reactor site and off-site.

The nuclear power industry has improved the safety and performance of reactors and it has proposed new and safer reactor designs.

23. What are the advantages and disadvantages of breeder reactor? (AU.(MECH)May'11)

Advantages:

- No moderators is required
- High breeding is possible.
- It gives high power density than other reactors.
- High efficiency in the order of 40% can be obtained.
- It has better fuel utilization.
- Absorption of neutrons is low.

Disadvantages:

- It has to be cooled with liquid sodium.
- It is even more complicated and expensive than a normal reactor.
- It has potential for misuse of plutonium by terrorists.

24. What factors control the selection of a particular type of a reactor?(AU.DEC'04)

- Neutrons energy
- Type of fuel
- Type of coolant.
- SFR: Sodium Fast Reactor
- SCWR: Super-Critical Water-Cooled Reactor.
- VHTR: Very High Temperature reactor cooled with helium at 1000°C at the core for efficient production of hydrogen.

25. What are the essential components of a nuclear reactor? (AU.(EEE)May'10)

- Reactor core
- Moderator
- Control rods
- Reflector
- Cooling system
- Reactor vessel
- Biological shielding.

26. What are the conditions to be satisfied to sustain nuclear fission process? OR Give the requirements of chain reaction. (AU.(MECH)May'09,DEC'13 & (EEE) May'10)

- i. The chain reaction will become self-sustaining or self propagating only.
- ii. At least one fission neutron becomes available for causing fission of another nucleus.
- iii. The neutrons emitted in fission must have adequate energy to cause fission of other nuclei.
- iv. The number of neutrons produced must be able not only to sustain the fission process but also to increase the rate of fission.
- v. The fission process must liberate the energy.
- vi. It must be possible to control the rate of energy liberation.

27. How are the nuclear reactors classified?(AU.(MECH)May'11)

- (i)According to the neutrons energy.
 - A)fast reactors in which fast fission is caused by high-energy neutrons.
 - B)Intermediate or epithermal.
 - c)Low energy to Thermal reactors in which fission is due to slow moving neutrons.
- (ii)According to the fuel used
 - a) Natural fuel reactor in which natural Uranium is used as fuel.
 - b) Enriched Uranium reactor in which Uranium used in this reactor contains 5 to 10% of U^{235} .
- (iii)According to the type of coolant used
 - a)water cooled reactors in which ordinary or heavy water is used as coolants.
 - b) Gas cooled reactors in which CO_2, He, N_2, air etc. are used as coolants.
 - c)Liquid metal cooled reactors in which liquid metals such as sodium, bismuth and lead are used as coolants.
- iv)According to the type of moderators used
 - a.Graphite moderator reactor.
 - b.Beryllium moderator reactor.
 - c.Water moderator reactor.
- v)According to the construction of core
 - a.Cubical core reactor.
 - b.Cylindrical core reactor.
 - c.Spherical core reactor.
 - d.Annulus core reactor.
 - e.Slab core reactor.

28. Distinguish between PHWR and LMFBR.

(AU.(EEE) May'11)

S.No	PHWR	LMFBR
1	A nuclear power reactor commonly uses unenriched natural uranium as its fuel which uses heavy water (deuterium oxide D_2O) as its coolant and moderator.	A nuclear reactor is capable of generating more fissile material than it consumes.
2	Pressurized heavy water reactors (PHWR) running on natural uranium have a conversion ratio of 0.8.	The conversion ratio is higher than 1.
3	It is costly.	Its cost is comparatively less..

29. State the major reasons for nuclear accidents that classified under moderate frequency.

The major reasons for nuclear accidents of moderate frequency are imbalance in head rates, increase in thermal power and reduction in cooling effectiveness.

30. State the major reasons for nuclear accidents that classified under severe accidents.

The major reasons for nuclear accidents of severe category are large break of loss coolant, loss of power in reactor station and failure of reactor protection system.

31. What are the major reasons for nuclear accidents that classified under lower probability?

Cracks in coolant pipes and loss of flow are the major reasons for nuclear accidents of lower probability
PART-B& PART-C
<p>1. (i) Explain CANDU (Canadian-Deuterium-Uranium) reactor with neat diagram also mention its merits and demerits. (ii) Discuss about the safety measures adopted in modern nuclear plants. [AU Nov/Dec 2016] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>2. What is meant by uranium enriched? Describe some methods of Uranium enrichment. [AU JUNE 2010] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>3. Explain the Construction and working of nuclear power plant with a layout. [AU DEC 2010, 2012, 2013][AU Nov/Dec 2016] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>4. Explain the different types of nuclear reactions and initiation of nuclear reactions. [AU JUNE 2013] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>5. Explain with a neat sketch a boiling water reactor.[AU DEC 2007,2005/NOV 2007] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>6. Explain the working of pressurized water reactor.[AU MAY 2011,2014/DEC 2014] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>7. What is chain reaction? How it is maintained? What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples' [AU DEC 2004/NOV 2007] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>8. Discuss the various factors to be considered while selecting the site for nuclear power station. [AU DEC 2014] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
UNIT IV POWER FROM RENEWABLE ENERGY
Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.
PART-A
<p>1. Define the term “Hydrology”. (AU.(EEE)DEC’10) Hydrology is the study of science concentrating the properties of the earth’s water and the movement of earth with respect to land.</p>
<p>2. What is hydrograph? (AU.(MECH)May’13) A hydrograph is a graph plotted for the rate of flow versus time past a specific point in a river or other channel or conduit carrying flow.</p>
<p>3. For which purposes hydro projects are developed? (AU.(EEE)DEC’13) i. To meet the power needs during peak and off peak requirements. ii. To run of the river. iii. To obtain a clean process of power generation iv. To avoid suffering from the limitation of inflation on account of fuel consumption in the long run.</p>
<p>4. What is the purpose of using dams? (AU.(EEE)DEC’12)</p>

<p>The dam is used in hydro power plants to increase the height of water level thereby increasing the capacity of reservoir. The dam also helps to increase the working head of the power plant.</p>	
<p>5. Define Run-off.</p>	<p>(AU.(EEE)DEC'13)</p>
<p>Runoff is defined as the movement of land water to the ocean mainly in the form of rivers,lakes and streams</p>	
<p>6. Classify power plants on the basis of traditional use.</p>	<p>(AU.(MECH)May'11)</p>
<p>i. Concrete gravity dam type hydroelectric power plant. ii. Embankment dam type hydroelectric power plant.</p>	
<p>7. List out the important parameters of a turbine.</p>	<p>(AU.(MECH)Nov'07)</p>
<p>i. Power output of the turbine. ii. Friction losses based on isentropic efficiency. iii. Maximum temperature which can be taken by the turbine. iv. Temperature at the exhaust of the turbine.</p>	
<p>8. Give an example for a low heat turbine , a medium head turbine and a high head turbine.</p>	<p>(AU.(MECH)Nov'02)</p>
<p>a) High head turbine(above 250m).e.g.Pelton wheel. b) Medium head turbine(60m to 250 m).e.g. Modern Francis turbine. c) Low head turbine(less than 60 m).e.g.Kaplan turbine.</p>	
<p>9. What are reaction turbines? Give examples.</p>	<p>(AU.(MECH)Apr'03)</p>
<p>In a reaction turbine,the runner utilizes both potential and kinetic energies. Here,a portion of potential energy is converted into kinetic energy before entering the turbine.eg.Francis and Kaplan turbine</p>	
<p>10. What is a draft turbine?</p>	<p>(AU.(EEE)DEC'10)</p>
<p>After passing through the runner, the water is discharged to the tailrace through a gradually expanding tube called draft tube. The pressure at the exit of the runner of a reaction turbine of generally less than atmospheric pressure. By passing through reduced size draft tube, the outer velocity of water is reduced and gain in useful pressure head is achieved to increase the output of turbine.</p>	
<p>11. What is the function of draft tube?</p>	<p>(AU.(EEE)DEC'11 & June'13)</p>
<p>1. It allows the turbine to be set above tail. Water level is without loss of head for doing inspection and maintenance. 2. It regains the major portion of the kinetic energy delivered from the runner by the diffuse action.</p>	
<p>12. What are the different types of spill ways?</p>	<p>(AU.(EEE)DEC'11)</p>
<p>i. Chute spillway ii. Stepped spillway iii. Bell-mouth spillway.</p>	
<p>13. Define unit speed of turbine.</p>	<p>(AU.Nov'03)</p>
<p>Unit speed is defined as the speed of turbine when working under a unit head. Unit speed $N_s = N/\sqrt{H}$</p>	
<p>14. What is the significance of specific speed of hydraulic turbines?</p>	<p>(AU.(MECH) May'09 & May'11)</p>
<p>1. To predict the behaviour of a turbine working under different conditions. 2. To make the comparison between the performances of turbine of same types with different sizes. 3. To compare the performance.</p>	
<p>15. What is a surge tank?</p>	<p>(AU.(EEE)May'10)</p>
<p>A surge tank is a small reservoir or tank in which the water level rises or falls to reduce.</p>	
<p>16. What is draft tube? In which type of turbine it is mostly used?</p>	<p>(AU(MECH) Nov'03 & Nov'04)</p>
<p>The tube which increases the outlet velocity of turbines is known as draft tube. So , the head is saved by fitting a draft tube.</p>	
<p>17. What is the necessity if draft tubes? List the types.</p>	<p>(AU.(MECH) May'09 & May'11)</p>

<ol style="list-style-type: none"> 1. To Decreases the pressure at the runner exit less than the atmospheric pressure in order to increase the working head. 2. To recover some of kinetic energy going to tail race as waste. <p>Types of draft tube: Draft tubes are classified into two types.</p> <ol style="list-style-type: none"> (i) Straight conical or concentric tube. (ii) Elbow type (iii) Moody spreading type
<p>18. Write the function of draft tube in turbine outlet. (AU.(MECH) Apr'05)</p> <ol style="list-style-type: none"> 1. It allows the turbine to be set above tail-water level without loss of head for doing the inspection and maintenance. 2. It regains the major portion of the kinetic energy delivered from the runner by the diffusion action.
<p>19. What are the factors to be considered in selecting turbines? (AU.(MECH)May'14 &(EEE) May'12)</p> <ol style="list-style-type: none"> 1. Rotational speed of the turbine 2. Specific speed 3. Maximum efficiency 4. Part load efficiency 5. Head 6. Types of water 7. Runaway speed 8. Cavitation 9. Number of turbine units 10. Overall cost.
<p>20. On what basis hydraulic turbines are selected? (AU.(MECH).DEC'12)</p> <ol style="list-style-type: none"> 1. Water availability 2. Water storage 3. Water head 4. Various geological investigations 5. Environmental aspects 6. Consideration of water pollution effects
<p>21. What do you understand by zero energy houses? (AU(EEE)June'13) A zero energy building is also known as a zero net energy(ZNE) or net-zero energy building(NZEB). It refers a building with zero net energy consumption and zero carbon emissions annually.</p>
<p>22. List any four advantages of wind turbine. (AU.(EEE)DEC'10)</p> <ol style="list-style-type: none"> i. Wind industry developers and manufacturers make lots of money by investing them due to government subsidies and cash incentives. ii. They make the environmentalists happy may be because man is finally punished against the earth.
<p>23. What are the advantages of pumped storage plant? (AU.(EEE)DEC'10)</p> <ol style="list-style-type: none"> a. It is free from effects of environment pollution. b. Such plants are readily adoptable to automation as well as remote control.
<p>24. What is the purpose of flywheel which is used in an IC engine?(AU.Apr'08) A flywheel is a heavy rotating mass which is placed between power source and driven member to act as a reservoir of energy. The primary function of flywheel is to act as an “energy accumulator:”. It will absorb the energy when the demand is less than the supply of energy and will release it when the demand is more than the energy being supplied.</p>
<p>25. What is the function of flywheel? (AU.Nov'05 & DEC'06)</p>

A flywheel used in machine serves as a reservoir which stores energy during the period when the supply of energy is more than the requirement and releases it during period when the requirement of energy is more than supply.

26. What are the components of tidal power plants? (AU.(MECH)May'09)

1. The dam or dyke
2. Sluice ways
3. The power house.

27. What are the different methods of producing electricity with tides? (AU.(MECH)May'11)

1. Single basin arrangement
 - a) Single ebb-cycle system
 - b) Single tide-cycle system
 - c) Double cycle system
- d) Double basic arrangement

28. What is a solar cell? (AU.(EEE)May'12 &DEC'12)

A solar cell is a device which directly converts the energy of light into electrical energy through the process of photovoltaic effect.

29. What are the classifications of geothermal energy? (AU.(EEE)DEC'11,DEC'12 & June'13)

- i. Hydrothermal convective systems
- ii. Geopressured resources
- iii. Petro-thermal or hot dry rocks
- iv. Magma resources
- v. Volcanoes.

30. What are the types of geothermal power plants? (AU.(MECH)DEC'13)

1. According to geothermal energy resources
 - a. Geothermal steams
 - b. Geothermal brine
 - c. Geothermal hot water
 - d. Hot rock
2. According to thermodynamic cycle
 - a. Steam turbine cycle
 - b. Binary cycle
 - c. Total flow concept.

31. What is bio gas? Give the advantages. [AU Nov/Dec 2016]

Biogas is a type of gas that is formed by the biological breakdown of organic matter in an oxygen deficient environment. It is counted as an ecofriendly biofuel. Biogas contains 60% methane and carbon dioxide. It can be employed for generating electricity and also as automotive fuel. Biogas can be used as a substitute for compressed natural gas (CNG).

Advantages

- a. Provides a non-polluting and renewable source of energy.
- b. Efficient way of energy conversion (saves fuelwood).
- c. Leads to improvement in the environment, and sanitation and hygiene.
- d. Provides a source for decentralized power generation.
- e. Leads to employment generation in the rural areas.
- f. Household wastes and bio-wastes can be disposed of usefully and in a healthy manner.

32. List the difference between Francis and Kaplan turbine.[AU Nov/Dec 2016]

Difference between Francis turbine and Kaplan turbine		
	Francis turbine	Kaplan turbine
1.	It needs one servomotor for regulation of direct vanes.	It requires servomotors for regulation of vanes with turning runner blades.
2.	Shaft might be placed horizontally and vertically.	Shaft of runner is for all time vertical.
3.	Precise speed range as of 50 to 250.	Precise speed ranges as of 250 to 850.
4.	Servomotor is located outside rotor shaft.	Servomotors are located inside hollow shaft of turbine runner.
5.	Flow of water is radially and mixed flow type.	It is simply axial flow turbine.
6.	Number of vanes is big (16 to 24 blades).	Number of vanes is little (3 to 8 blades).
7.	Runner vanes is not regulating.	Runner vanes are regulating.
8.	Turbine works by middle discharge at average head.	It works by high discharge by low heads.

PART-B& PART-C

1. What are the essential elements of hydro power plant? Explain with a neat sketch.

[AU NOV 2008/MAY 2011/DEC 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

2. Explain the working of Pelton turbine with a neat diagram. What is the function of a draft tube?

[AU NOV 2012/MAY 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

3. Describe the working of a low head hydro plant with a neat diagram. [AU DEC 2014]

[AU Nov/Dec 2016]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

4. Compare and contrast Kaplan turbine and Francis turbine. [AU APR 2004]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

5. Discuss various components of wind energy system. [AU DEC 2014]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

6. Explain with a neat sketch a pumped storage power plant

[AU NOV 2007/MAY 2010, DEC 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

7. Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches.

[AU NOV 2008]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

8. Draw a schematic diagram of a solar power plant and explain the operation of it. Also mention its merits and demerits.

[AU NOV 2009]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

9. Explain the construction and working of geo thermal power plant and tidal power plants.

[AU MAY 2011]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

10. Define the terms anaerobic digestion, Fermentation and What are the advantages and disadvantages of floating drum plant Give the list of the materials used for biogas generation.

[AU DEC 2014]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

11. Describe the principle of a fuel cell and discuss the choice of fuels required.

[AU DEC 2013]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

12. (i) Explain the construction and working of fuel cell also mention its merits and demerits.

(ii) List the advantages and disadvantages of wind energy system. [AU Nov/Dec 2016]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

13. Explain with a neat sketch working of a distributed (Parabolic) trough Solar Power Plant.

[AU DEC 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

UNIT VENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

PART-A

1. What is main objective of tariff?

[AU Nov/Dec 2016]

- Recovery of cost of producing electrical energy at the power station.
- Recovery of cost on the capital investment in transmission and distribution systems.
- Recovery of cost of operation and maintenance of supply of electrical energy *e.g.*, metering equipment, billing etc.
- A suitable profit on the capital investment.

2. Define law of conservation of Energy.

(AU(EEE)DEC'13)

Energy may be neither create nor destroyed but it can be transferred from one form to another form.

3. What is the significance of incremental rate for a power plant?(AU.DEC'04)

Boiler efficiency is defined as the ratio of heat energy used in system formation to the heat energy supplied by burning of fuel in the same period but the incremental heat rate is the reciprocal of boiler efficiency.

4. What are the various operating costs of fired steam power plant?(AU.Apr'05)

- a) Cost of fuel
- b) Lubricating oil, grease water cost
- c) Cost of maintenance and repairs
- d) Cost of operating labour
- e) Cost of supervision
- f) Taste.

5. Define demand for electricity.

(AU.(EEE)DEC'13)

It is defined as the electricity requirement during the period of time of high price or more stress

6. Define "Diversity factor".

(AU.DEC'05)

Diversity factor is defined as the ratio of sum of the individual maximum demand to the actual peak load of the system.

Diversity factor = Sum of individual maximum demand/Actual peak load of the system.

7. Define plant use factor.

[AU Nov/Dec 2016]

The ratio of the average power load of a plant to its rated capacity.

8. What are the major factors that Decide the economics of power plants?

(AU.(MECH)Apr'08)

- i. Connected load
- ii. Demand

- iii. Maximum demand
- iv. Demand factor
- v. Load factor
- vi. Capacity factor or plant capacity factor
- vii. Utilization factor
- viii. Reserve factor
- ix. Diversity factor
- x. Plant use factor

9. What do you understand by load duration curves?(AU.(MECH) May'14)

Re-arrangement of all load elements of load curve is in the order of decreasing magnitude.

10. State the importance of load curves. (AU.(MECH)May'11)

- a. To obtain the average load on the power station and the maximum demand of the power station.
- b. To know the incoming load thereby helping to decide the installed capacity of the power station.
- c. To decide the economical sizes of various generating units.

11. What is the significance of load curve? (AU(MECH)May'13)

The load curve gives full information about the incoming load and it helps to decide the installed capacity of the power station. It is also useful to decide the economical sizes of various generating units.

12. What is the use of load curves in power plant? (AU(MECH)Apr'08)

Load curve is a graphical representation which shows the power demands for every instant during certain time period. By drawing these load curves, the peak load can be identified. Therefore, the capacity of power plant can be judged.

These curves give full information about the incoming load and they help to decide the installed capacity of the power station. It is also useful to decide the economical sizes of various generating units

13. How does the fuel cost related to the load and the cost of power generation?

(AU.(MECH)Nov'08 & Apr'11)

The cost of power generation is directly proportional to the fuel cost because the operating cost is directly linked with the fuel cost.

14. What are fixed? (AU.(MECH)DEC'12 & May'14)

Fixed costs are the cost required for the installation of complete power plant. This cost includes the cost of land, buildings, equipment, transmission and distribution lines, cost of planning and designing the plant and many others. It also consists of interest, taxes, depreciation, insurance etc.

15. Define flat rate tariff. (AU (MECH)May'11 & DEC'13)

The charging of amount depending only on the connected load and fixed number of hours of use per month or year is called flat rate tariff.

16. List the types of tariffs to calculate energy rate. (AU (MECH)DEC'12)

- a. Flat demand rate
- b. Straight line meter rate
- c. Block meter rate
- d. Hopkinson demand rate of two-part tariff
- e. Doherty rate or three part tariff.

17. How the tariff for electrical energy is arrived? (AU (MECH)May'11)

Tariff is calculated by the following equation.

$$E = Ax + By + C$$

Where

E = Total amount of bill for the period considered

A = Rate per kW of maximum demand

X = Maximum demand in kW

B = Energy rate per kWh

Y = energy consumed in kWh during the period considered

C=Constant amount charged to the consumer during each bill period. This charge is independent of demand or total energy.

18. Define depreciation.

It is the amount to be set aside per year from income to meet the depreciation caused by the age of service, wear and tear of machinery.

19. Mention any four methods for calculating depreciation.

- Straight line method
- Sinking fund method
- Diminishing value method
- Net percent value method
- Double sinking fund method.

20. What is the reason for the operating cost of hydel power plant being high?

No fuel cost is required for running the power plant.

21. How can be the cost of power generation reduced?

- Periodic maintenance.
- Installing waste heat recovery system.
- Using energy efficient devices such as insulated compressors and insulated turbines.
- Using higher grade fuels.

22. What are the factors that contribute for energy cost?

- Cost of fuel.
- Cost of operating labour.
- Cost of maintenance labour and materials.
- Cost of supplies

23. List out four important factors to be considered for the selection of site for power plants,

- Cost of land as well as taxes on land.
- It should be near load centers.
- It should be accessible by road, rail etc.,
- Sufficient quantity of cooling water should be available.
- The selected site should be away from the populated area
- Enough space should be available for future expansion of plants
- The selected site should satisfy geological factors.

24. What are the different pollutions in the flue gas?

- Oxides of nitrogen
- Oxides of sulphur
- Carbon monoxide
- Particulates.

25. What are the methods used for reduction of SO₂ pollutant?

- Adding lime stone (CaCO₃) to the coal
- Using wet scrubbers
- Using electro static precipitator.

26. What are the methods used for controlling the NO_x?

- Reduction of temperature in combustion zone.
- Reduction of residence time in combustion zone.
- Increase in equivalence ratio in the combustion zone.

27. What is Acid rain?

CO, SO and NO contact the water during rainy season. So, H₂SO₄ and HNO₃ acids are formed and mixed

with water during rainfall.
<p>28. What is the equipment used to control the particulates?</p> <ul style="list-style-type: none"> • Scrubbers • Cyclone separator • Fabric filters • Electro static precipitators
<p>29. List down the nuclear waste disposal methods.</p> <ul style="list-style-type: none"> • Disposal in sea. • Disposal in land. • Disposal by reduction process through chemical reaction. • Disposal by solidification process.
<p>30. What are the various methods followed to transport solid waste?</p> <p>(i) Wet slurry method: This method uses water slurry to transport the material to the disposal area.</p> <p>(ii) Pneumatic method: This method uses the air to transport solid wastes to the disposal area.</p> <p>(iii) Trucking.</p> <p>(iv) Rail transport.</p> <p>(v) Conveyor usually fixed or movable belt conveyor systems is used, and</p> <p>(vi) Barge uses waterways to transport waste materials.</p>
<p>31. What are operating costs? (AU.(MECH)DEC'12 & May'14)</p> <p>Operating cost includes the cost of fuel, cost of lubricating oil, greases, cooling water, cost of maintenance and repairs, operating labour cost, supervision cost and taxes.</p>
<p>32. What are the costs involved in fired steam power plant?(AU.Apr'05)</p> <ul style="list-style-type: none"> • Maintenance and repairs cost • Operating labour cost • Supervision cost
PART-B& PART-C
<p>1. Explain the methods to control pollution in thermal and nuclear power plants. [AU Nov/Dec 2016] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>2. Write an explanatory note on the economics of power generation. [AU DEC 2014] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>3. What is meant by load factor and diversity factor? [AU APR 2005] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>4. Elucidate the objectives and requirements to tariff and general form of tariff. [AU MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>5. What are the elements which contribute to the cost of, the electricity? And how can the cost power generation be reduced? [AU APR 2008] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>6. Explain briefly the various methods used to, calculate the depreciation cost. [AU MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>7. What are the fixed and operating costs of steam power plant? How are they accounted for fixing cost of electricity? [AU MAY 2011/2014] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>8. Explain the analysis of pollution from thermal power plants. What is methods used for control the</p>

pollutants?

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

9. Write short notes on nuclear waste disposal.

[AU APR 2008/NOV 2008]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

10. Explain the site selection criterion of hydro power plant.

(ii) A peak load on the thermal power plant is 75 MW. The loads having maximum demands of 35 kW, 20 MW, 15 MW and 18 MW are connected to the power plant. The capacity of the plant is 90 MW and annual load factor is 0.53. Calculate the average load on power plant, energy supplied per year, demand factor and diversity factor. **[AU Nov/Dec 2016]**

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

Department of Mechanical Engineering
Mechatronics
Question Bank

UNIT I INTRODUCTION

Introduction to Mechatronics– Systems– Concepts of Mechatronics approach– Need for Mechatronics– Emerging areas of Mechatronics– Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers–LVDT–Capacitance sensors–Strain gauges– Eddy current sensor –Hall effect sensor–Temperature sensors–Light sensors.

PART-A

1. Define Mechatronics.

The term Mechatronics is used for the integration of microprocessor control system, electrical systems and mechanical systems. Mechatronics is defined as the integration of precision mechanical & electronic control for the development of smart products & process.

2. What is a system? Give an example.

A system can be considered as a box, which has an input, and an output and where it is not concerned with what goes on inside the box but only the relationship between the output and the input. Example: A motor may be thought of as a system, which has as its input electric power and as output the rotation of a shaft.

3. What is a measurement system?

A measurement system can be considered as a black box, which is used for making measurements. It has as its input the quantity being measured and its output the value of that quantity. Design skill – Ability to solve problems which will benefit the company.

4. Write about the sensor and give an example.

A sensor, which responds to the quantity being measured by giving as its output a signal which is related to the quantity. Example: A thermocouple is a temperature sensor. The input to the sensor is a temperature and the output is an e.m.f. which is related to the temperature value.

5. Write about the signal conditioner?

A signal conditioner takes the signal from the sensor and manipulates it into a condition, which is suitable for either display, or in the case of a control system, for use to exercise control.

6. What are the two basic forms of the control system?

The two basic forms of the control systems are,

- a. Open loop control system.
- b. Closed loop control system.

Type Advantage Disadvantage

Open Loop a. It is being relatively simple

- i. Low cost
- ii. Good reliability
- iii. Inaccurate since there is no
- iv. Correction of error

Closed Loop Accurate in matching the actual to the required values.

- a. More complex
- b. More costly
- c. Greater chance of breakdown as a consequence of the greater number of components..

7. What are the elements of the closed loop control system?

The various elements of a closed loop control system are,

- a. Comparison element
- b. Control element
- c. Correction element
- d. Process element
- e. Measurement element

8. What are the two types of feedback loop?

The two types of feedback loop are,

- a. Positive feedback loop
- b. Negative feedback loop.

"The feedback is said to be negative/positive feedback when the signal; which is feedback, subtracts/adds from the input value. It is required to control a system.

The control elements decide what action to take when it receives an error signal"

9. What are the types of control elements?

There are two types of control elements. They are

- a. Hard – wired systems
- b. Programmable systems.

10. What are the various elements of a closed loop system for a person controlling the temperature?

The various elements of a closed loop system are,

- 1. Controlled variable
- 2. Comparison element
- 3. Error signal
- 4. Control unit
- 5. Measuring device

For example,

Controlled variable - The room temperature Reference value (The required room temperature)
 Comparison element - The person comparing the measured value with the required value of temperature.
 Error signal - The difference between the measured and required temperatures Control unit - The person Correction unit - The switch on the fire Process - The heating by the fire
 Measuring device - A thermometer

11. Write about the Mechatronics approach in a micro-processor – controlled washing machine?

In the microprocessor-controlled washing machine, a mechanical system has become integrated with electronic controls. As a consequence, a bulky mechanical system is replaced by a much more compact microprocessor system, which is readily adjustable to give a greater variety of programs.

12. What is the larger scale application of Mechatronics?

A larger scale application of Mechatronics is a Flexible Manufacturing engineering System (FMS) involving computer – controlled machines, robots, automatic material conveying and overall supervisory control.

13. List some of the applications of Mechatronics?

1. Home Appliances: Washing machine, Bread machines etc
2. Automobile: Electrical fuel injection, Antilock brake system
3. Aircraft: Flight control, Navigation system
4. Automated Manufacturing

14. What are the components of Mechatronics System?

1. Actuators
2. Sensors
3. Signal Conditioning units
4. Digital control devices
5. Graphical Displays

15. What is meant by a system in Mechatronics?

The System is the group of physical component combined to perform a specific function. Any mechatronics devices consists of systems

16. What are the main applications of mechatronics?

Washing machines, dish washers, micro ovens, cameras, camcorders, robots, automatic conveyors, computer-controlled machines

17. Draw the block diagram of measurement system.

Quantity value
 measured
 Transducer or
 Sensor
 Signal
 Processor Recorder


18. Sketch the graphical representation of mechatronics system.

Mechanical System
 Graphical Displays

LEDs
 LCD
 Digital Display
 CRT
Output Signal
Conditioning and interfacing
 D/A, D/D
 Amplifier
Power
Transistor

19. Obtain the basic functions of control systems.

1. To minimize the error between the actual and desired output
2. To minimize the time response to load changes in the system

20. What are the types of control system?

- Open loop system
- Closed loop system

21. List down the requirements of control systems.

- Stability
- Accuracy
- Response

22. Give an example for open loop system and closed loop systems.

1. Closed loop system – Automatic water level controller
2. open loop system - Electric fire

23. Compare open loop control system and closed loop control system.

Open loop systems Closed loop systems

- It is suitable where accurate positioning of the tools is not required
- System is very simple
- It is suitable for rough works
- Error is not currently checked and rectified
- The feedback signal controls the table position accurately
- Is used almost in all automation process
- Its not suitable for rough works
- Error is currently checked and rectified

24. What are the basic elements of feedback system?

- Forward path
- Feedback path
- Error detecting device
- Amplifier
- Compensating network

25. What is meant by sequential control what are the two modes in it?

A system operating with sequential control is one where a set of prescribed operations are performed in sequence. The modes are, ☐Event – based mode, ☐Time – based mode

25. Give an example for event-based and time-based sequential control.

☐Time-based Water Heater

☐Event-based Domestic washing machine

PART-B

1. Write a detailed note on pressure measuring system and pressure measuring transducer.

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No: 9

2. Discuss about the overall development of management thought. Explain the important contributions of Henry Fayol and Taylor in the field of management thoughts. (NOV 2017, MAY 2016, MAY 2015, MAY 2014, MAY 2013, MAY 2012)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008. ”, Page No from 28 to 38.

3. Explain briefly about the different factors affecting the organizational environment. (MAY 2015)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008. ”, Page No from 46 to 51.

4. What is organizational culture? Explain the types of organizational culture. Explain the issues of organizational culture in modern organizations. (MAY 2017, MAY 2011)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No from 51to 60.

5. Explain the types of Business organization. (Or Elucidate any four types of organization). (MAY 2017, MAY 2015, MAY 2014)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008. ”, Page No from 547 to 549.

6. Explain the trends and challenges of management in global scenario. Brief about the functions of MNC. (NOV 2017, MAY 2013, MAY 2012, NOV 2012)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No from 98 to116.

UNIT II 8085 MICROPROCESSOR AND MICROCONTROLLER

Introduction–Architectureof8085–PinConfiguration–AddressingModes–Instructionset, Timing diagramof8085–Conceptsof8051microcontroller–Blockdiagram.

PART-A

1. What is the purpose of a sensor?

Sensor is used for an element which produces a signal relating to the quantity being measured. I.e., an electrical resistance temperature element, the quantity being measured is temperature and the sensor transforms an input of temperature into a change in resistance.

2. Define transducer?

The term transducer is often used in place of the term sensor. Transducer is defined as elements that when subject to some physical change experience a related change. Thus, sensors are transducers.

3. What are the terms that define the performance of the transducers?

1. Range and span
2. Error
3. Accuracy
4. Sensitivity
5. Hysteresis error
6. Non – linearity error
7. Repeatability / reproducibility
8. Stability

- 9. Dead band / time
- 10. Resolution
- 11. Output impedance.

4. Define static characteristics?

The static characteristics are the values given when the steady – state conditions occur. i.e., the values given when the transducer has settled down after having received some input.

5. Define dynamic characteristics?

The dynamic characteristics refer to the behavior between the time that the input value changes and the times that the value given by the transducer settles down to the steady – state value. Dynamic characteristics are stated in terms of the response of the transducer to inputs in particular forms.

6. What are the terms that you can find from the dynamic characteristics?

- 1. Response time.
- 2. Time constant.
- 3. Rise time
- 4. Settling time.

7. What is a displacement sensor?

Displacement sensors are concerned with the measurement of the amount by which some object has been moved.

8. What is a position sensor?

Position sensors are concerned with the determination of the position of some object with reference to some reference point.

9. What is a proximity sensor?

Proximity sensors are a form of position sensor and are used to determine when an object has moved to within some particular critical distance of the sensor.

10. What are the two basic types of the displacement and the position transducers?

The two basic types are,

- 1. Contact sensors
- 2. Non contact sensors.

11. Write about the strain – gauged element?

The electrical resistance strain gauge is a metal wire, metal foil strip, or a strip of semiconductor material, which is wafer – like and can be stuck onto surfaces like a postage stamp.

12. Define gauge factor.

The gauge factor is defined as the ratio of per unit change in resistance to per unit change in length.

$$\text{Gauge factor } G_f = \Delta R/R/\Delta L/L$$

13. Write about the gauge factors for different types of strain gauges?

The gauge factor of metal wire or foil strain gauges with the metals generally used is about 2.0. Silicon p – and n – type semiconductor strain gauges have gauge factors of about + 100 or more for p- type silicon and – 100 or more for n – type silicon.

14. What is the capacitance of a parallel plate capacitor?

The capacitance of a parallel plate capacitor is given by,

$$C = \epsilon A/d = \epsilon_r \epsilon_0 A/d$$

Where

ϵ = Permittivity of the medium/m

ϵ_r = Relative permittivity

ϵ_0 = Permittivity of the free space = $8.85 \times 10^{-12} \text{F/m}$

A = Area of plates

D = Distance between two plates

15. Define LVDT?

The Linear Variable Differential Transformer consists of three coils symmetrically spaced along an insulated tube. The central coil is the primary coil and the other two are identical secondary coils, which are connected in series in such a way that their outputs oppose each other.

16. Determine the working Principle of LVDT?

When there is an alternating voltage input to the primary coil, alternating e.m.f.s are induced in the secondary coils. With the magnetic core central, the amount of magnetic material in each of the secondary coil is the same.

17. What are the uses of LVDT?

The uses are as follows.

- a. Widely used as primary transducers for monitoring displacements.
- b. Also used as secondary transducers in the measurement of force, weight and pressure.

18. Write about inductive proximity switch?

Inductive proximity switch consists of a coil wound round a core. When the end of the coil is close to a metal object inductance changes. This change can be monitored by its effect on a resonant circuit and the change used to trigger a switch. It can only be used for the detection of metal objects and is best with ferrous metals.

19. What is an encoder?

An encoder is a device that provides a digital output as a result of a linear or angular displacement.

20. What are the two types of position encoders?

The two types of position encoders are,

- a. Incremental encoders
- b. Absolute encoders.

21. What is an incremental encoder?

An incremental encoder is used for the measurement of angular displacement. A beam of light passes through slots in a disc and is detected by a suitable light sensor. When the disc is rotated, the sensor produces a pulsed output with the number of pulses being proportional to the angle through which the disc is rotated. Hence, the angular position of the disc is determined.

22. Write about absolute encoder?

An absolute encoder is used for the measurement of angular displacement. This gives an output in the form of a binary number of several digits, each such number representing a particular angular position. The rotating disc has three concentric circles of slots and three sensors to detect the light pulses.

23. What are the uses of photosensitive devices?

Photosensitive devices can be used to detect the presence of an opaque object by it breaking a beam of light or infrared radiation, falling on such a device or by detecting the light reflected back by the object.

24. Write about Hall effect sensors?

When a beam of charged particles passes through a magnetic field, forces act on the particles and the beam is deflected from its straight line path. A current flowing in a conductor is like a beam of moving charges and thus can be deflected by a magnetic field.

25. What is Hall co-efficient?

The transverse potential difference is given by, $V = KHBI$

Where, b

KH = Hall co-efficient

B = Magnetic flux density at right angles to the plate,

I = Current

<p>26. What are digital signals? Digital signals are discrete time signals in that they are not continuous functions of time but exist at only discrete times.</p>
<p>27. Why the signal conditioning is required? Signal conditioning of analogue signals requires components such as amplifiers filter circuits and digital signal microprocessor.</p>
PART-B & PART-C
<p>1.Explain two types gear drives in mechatronics system. (MAY 2014) <i>Refer: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085.", Page No from 547 to 549.</i></p>
<p>2.Explain construction and working principle of AC and DC motor. (MAY 2014, DEC 2013) <i>Refer: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085", Page No:265 to 274.</i></p>
<p>3.i) What is the principle and construction of vane pump and vane motor? ii) Describe the basic details of basic details of a 4/2 valve and 5/2 valve. (DEC 2013) <i>Refer: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085.", Page No from 109 to 114.</i></p>
<p>4.i)List the various types of bearing. Also mention their capabilities and applications. ii) Describe the working of an AC servo motor. (MAY 2013) <i>: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085.", Page No from 132 to133.</i></p>
<p>5.i) Explain different types of cam and followers. ii) A toothed gear has 72 teeth and circular pitch of 26mm, find pitch diameter, diametral pitch and module of the gear. (MAY 2013) <i>Refer: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085.", Page No from 142 to146.</i></p>
<p>6.With the help of proper control circuits explain the speed control of AC and DC motors. (DEC 2012) <i>Refer: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085.", Page No from 182 to186.</i></p>
<p>7.i) Using simple circuit explain the basic components required for a hydraulic actuation system. ii) List the types of bearings and brief about each.(DEC 2012) <i>Refer: "RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085.", Page No from 272 to273.</i></p>

UNITIII PROGRAMMABLEPERIPHERAL INTERFACE
<p>Introduction–Architectureof8255,Keyboardinterfacing,LEDdisplay–interfacing,ADCandDAC interface, TemperatureControl–StepperMotorControl–Traffic Controlinterface.</p>
PART-A
<p>1. Define Actuator. An actuator is an output device which performs useful works.</p>
<p>2. Classify actuator based on motion. 1. Linear motion ☑Single acting cylinder ☑Double acting cylinder 2. Rotary Motion</p>

- ☒ Air motors
 - ☒ Rotary actuators
3. Flow Control valve

3. When is cascade control Needed?

The need for cascade control will occur when a final control element experiences signal overlap i.e. when a trip valve mechanism is still held down , but the output signal has to been used and requires removal.

4. Write down the principles of cascade control.

- ☒ A simple design procedure to determine the minimum number of groups in the circuit
- ☒ Evolve separate supply bus for each group
- ☒ Arrange selector valves to divert the supply to whichever is the active group

5. Mention the various components of a hydraulic system.

- ☒ Motor
- ☒ Filter
- ☒ Pump
- ☒ Pressure Regulator
- ☒ Control Valve
- ☒ Piston and cylinder

6. What is called a pneumatic system?

System using gas for power transmission are called pneumatic systems and industrial system are usually based on air.

7. List down the components of pneumatic system.

- ☒ Motor driven compressor
- ☒ Air receiver
- ☒ Directional control
- ☒ Pneumatic cylinder

8. What is the purpose of using filters in the hydraulic systems?

Filters are used to prevent dirt or dust entering important elements of hydraulic system like valves, seals, etc. Filters are used to remove very finer particles.

9. What are the types of pumps used as energy source in a hydraulic system?

- ☒ Centrifugal Pump(Hydrodynamic Pumps)
 - ☒ Positive displacement pump
1. Gear Pumps
 2. Vane Pumps
 3. Piston pumps

10. What are the factors to be considered for selecting compressors?

The type of air compressor is selected dependent on quality of air, pressure and cleanliness

11. What are the uses of air receiver?

An air receiver is used to store high pressure air and provide constant supply of air pressure in the pneumatic system regardless of varying and fluctuating consumption. It is used for the emergency supply of air to the system in case of power failure.

12. State the purpose of providing air dryers.

The aim is to reduce the temperature of the air to a dew point which ensures that the water in the air condenses and drops out easily.

13. State the function of a control valve.

The primary function of the control valve is to direct and regulate the flow of fluid from an energy source to

various loading devices. Normally the control valves are used for the purpose of sensing, processing, and controlling. They are used for:

- ☒ Allowing the passage of air/fluid and directing it to a loading line
- ☒ Cancel the signal by blocking its passage
- ☒ Alert or generate the signal
- ☒ Release the air to atmosphere or return the fluid to tank

14. List the different control valves.

- ☒ Directional control valve
- ☒ Non return valves
- ☒ Flow control valves
- ☒ Pressure control valves
- ☒ Combinational valves
- ☒ Solenoid valves

15. Define the term degrees of freedom.

The minimum number of independent displacement required to specify the system completely is called degrees of freedom

16. Define kinematic pair.

The two links or elements are joined together to form a pair. If the relative motion between them is completely or successfully constrained, the pair is known as kinematic pair.

17. When is cascade control needed?

The need for cascade control will occur when a final control element experiences signal overlap ie; when a trip valve mechanism is still held down, but the output signal has been use and requires removal.

18. List the features of synchronous motor.

- ☒ It operates at a current speed from no load to full load
- ☒ Power factor of the motor can be controlled easily

19. What is a stepper motor?

A stepper motor is a rotating machine which converts a DC voltage pulse into a series of discrete rotational steps. Each step position is an equilibrium position without further excitation, this makes it ideally suitable for the use with digital control

20. What is stepper motor?

A stepper motor is a device which transforms electrical pulses into equal increments of rotary shaft motion called steps.

21. What is servomotor?

The motors used in automatic control systems or in servomechanism are called servomotors. They are used to convert electrical signal into angular motion.

22. What is synchro?

A synchro is a device used to convert an angular motion to an electrical signal or vice versa.

23. At what conditions SPDT, DPST an DPDT switches are used?

- a. SPDT (Single Pole, Double Throw): When we require ON and OFF operation as the circuit is actuated, SPDT is used.
- b. DPST (Double Pole, Single Throw): When we need to turn two separate circuits ON and OFF simultaneously with a single switch, DPST is used.
- c. DPDT (Double Pole, Double Throw): When a switch is turned ON and OFF between N and O with double pole switches, DPDT is used.

24. What are the factors to be considered for selecting solenoids?

- a. The size of the mechanical load.
- b. The movement distance of plunger.

- c. The type of electrical connections.
- d. The type of value of current and voltage.

25. What is the principle of relay?

Relay is used for many control functions and essentially an electro-mechanical switch. It uses basic switching principles and solenoid actuation.

26. What is zener voltage?

In the reverse direction, the diode conducts very little when the voltage is below the breakdown value. This critical limiting value of reverse voltage is known as Zener voltage

27. Name three output characteristics of transistor configuration.

- a. Saturation region
- b. Active region

PART-B& PART-C

1. Discuss Briefly model building block for automatic suspension system and electrical motor. (NOV 2014, MAY 2013)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No:266 to 268 and from 271 to 272.

2. Discuss briefly the following control modes.

- a) PI controller
- b) PID controller(MAY 2016, MAY 2015, MAY 2013, MAY 2012)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No from 95 to 97.

3.i) Briefly explain ON OFF controllers and give their limitations.

ii) Describe and applications of proportional controllers and their limitations.(NOV 2014, MAY 2013)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No from 95 to 97.

4. i) Explain the system modeling of a chamber filled with fluid.

ii) Explain the various types of control modes.(MAY 2017, MAY 2016, MAY 2015)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No from 125 to 128.

5. i) Explain briefly a mathematical model of a vehicle moving on a road.

ii) Explain in detail about digital controllers..(MAY 2013, MAY 2012, NOV 2012)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No from 135 to 140.

6. Explain the model building using the basic building blocks for a

i)Automobile suspension system

ii) Electrical motor.(MAY 2015, MAY 2012, NOV 2012)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No from 205 to 207.

7. Discuss in detail about PI and PD mode electronic controllers. (NOV 2017, MAY 2017)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008. ", Page No from 95 to 97.

UNITIV PROGRAMMABLE LOGIC CONTROLLER

Introduction–Basicstructure– Inputandoutputprocessing–Programming–Mnemonics– Timers, countersandinternalrelays–Datahandling–SelectionofPLC.

PART-A

1. What is a microprocessor?

A microprocessor is a multipurpose, programmable, clock driven, registers –based electronic device that reads binary instructions from a storage device called memory, accepts binary data as input and processes data according to those instructions, and provides results as output.

2. What are the four components of a programmable machine?

A typical programmable machine can be represented with four components. a. Microprocessor b. Memory

c. Input d. Output.

3. Define the terms. a) Bus b) RAM c) ROM.

BUS

– A group of lines used to transfer bits between the microprocessor and other components of the computer system.

RAM

– Random Access Memory. Data is stored in a read / write memory.

ROM

– Read only Memory. A memory that stores binary information permanently. The information can be read from this memory but cannot be altered.

4. What the types of languages used?

The types of languages used are,

- a. Machine language
- b. Assembly language
- c. Low – level language
- d. High – level language.

5. What is a machine language?

The binary medium of communication with a computer through a designed set of instructions specific to each computer.

6. What is a assembly language?

A medium of communication with a computer in which programs are written in mnemonics. An assembly language is specific to a given computer.

7. What is low – level language?

A medium of communication that is machine – dependent or specific to a given computer. The machine and the assembly language of a computer are considered low – level languages. Programs written in these languages are not transferable to different types of machines.

8. What is a high – level language?

A medium of communication that is independent of a given computer. Programs are written in English – like words, and they can be executed on a machine using a translator (a compiler or an interpreter).

9. Differentiate a compiler and an interpreter?

Compiler – A program that translates English – like words of a high level language into the machine language of a computer. A compiler reads a given program, called a source code, in its entirety and then translated the program into the machine language, which is called an object code. **Interpreter** – A program that translates the English – like statements of a high – level language in to the machine language of a computer. An interpreter translates one statement at a time from a source code to an object code.

10. What are the two parts of an instruction?

An instruction has two parts.

Opcode

– Operation to be performed.

Operand

– The operand can be data (8 – or 16 – bit), address, or register, or it can be implicit.

The method of specifying and operand (directly, indirectly, etc.,) is called the addressing mode.

11. What are the types of bus?

The types of bus are,

- a. Address bus
- b. Data bus
- c. Control bus.

12. Define the term , Data Bus, Address bus, Control Bus

a. Address Bus

A group of lines that are used to send a memory address or a device address from the MPU to the memory location or the peripheral and is unidirectional. The 8085 microprocessor has 16 address lines.

b. Data bus

A group of bi-directional lines used to transfer data between the MPU and peripherals and is bi-directional. The 8085 microprocessor has eight data lines.

c. Control bus

Single lines that are generated by the MPU to provide timing of various operations.

13. Write about the 16 – bit register of a 8085 microprocessor?

The 8085 has two 16 – bit register.

a. The program counter

b. Stack pointer The program counter is used to sequence the execution of a program. The stack pointer is used as a memory pointer for the stack memory.

14. What are the two types of memories?

The two types of memories are,

a. Static memory (SRAM)

b. Dynamic memory (DRAM)

15. Write about the SRAM?

a. This memory is made up of flip – flops, and it stores the bit as a voltage.

b. Each memory cell requires six transistors.

c. The memory chip has low density, but high speed.

d. More expensive, and consumes more power.

e. Also known as cache memory.

16. What are the advantages of DRAM?

The advantages of DRAM are,

a. This memory is made up of MOS transistor gates and it stores the bit as a charge.

b. It has high density.

c. Low power consumption

d. Cheaper than static memory

e. Economic to use when the system memory size is at least 8K for small systems.

17. What are the disadvantages of DRAM?

The disadvantages of DRAM are,

a. The charge (bit information) leaks.

b. Stored information needs to be read and written again every few milliseconds this is called refreshing the memory.

c. Requires extra circuitry, adding to the cost of the system.

18. What is flash memory?

The flash memory must be erased either in its entirely or at the sector level. The memory chips can be erased and programmed at least a million times. The power supply requirement for programming these chips was around 12V, but now chips are available that can be programmed using a power supply as low as 1.8 V. Hence, this memory is ideally suited for low – power systems.

19. What are the interfacing devices?

The bus drivers increase the current driving capacity of the buses, the decoder decodes the address to identify the output port, and the latch holds data output for display. These devices are called interfacing devices. The

interfacing devices are semiconductor chips that are needed to connect peripherals to the bus system.

20. Write about buffer?

The buffer is a logic circuit that amplifies the current or power. It has one input line and one output line. The logic level of the output is the same as that of the input, logic 1 input provides 1 output. The buffer is used primarily to increase the driving capability of a logic circuit. It is also known as driver.

21. Define looping?

The programming technique used to instruct the microprocessor to repeat tasks is called looping. A loop is set up by instructing the microprocessor to change the sequence of execution and perform the task again. This process is accomplished by using Jump instructions.

22. What are the types of loops?

Loops can be classified in to two groups. They are,

- a. Continuous loop
- b. Conditional loop.

23. Write about the continuous loop?

A continuous loop is a set up by using the unconditional jump instruction. A program with a continuous loop does not stop repeating the tasks until the system is reset.

24. Write about the conditional loop?

A conditional loop is set up by the conditional jump instructions. The instructions check flags (Zero, Carry etc.,) and repeat the specified tasks if the conditions are satisfied. These loops usually include counting and indexing.

25. What are the instructions of a 8085 instruction set for data transfer from memory to the microprocessor?

The 8085 instruction set includes three memory transfer instructions. They are,

- a. MOV R,M : Move from Memory to Register
- b. LDAX B/D : Load Accumulator Indirect
- c. LDA 16 – bit : Load Accumulator Direct

26. What are the instructions of a 8085 instruction set for data transfer from microprocessor to the memory?

The 8085 instruction set includes three memory transfer instruction. They are,

- a. MOV. R,M : Move from Memory to Register
- b. STAX B / D : Store Accumulator Indirect
- c. STA 16 – bit : Store Accumulator Direct
- d. MVI M, 8 – bit : Load 8 – bit data in memory.

27. What are the opcodes related to rotating the accumulator bits?

The opcodes related to rotating the accumulator bits are,

- a. RLC – Rotate Accumulator Left through Carry
- b. RAL – Rotate Accumulator Left
- c. RRC – Rotate Accumulator Right through Carry
- d. RAR – Rotate Accumulator Right

28. What is dynamic debugging?

After the steps have been completed in the process of static debugging, and if the program still does not produce the expected output, attempt is made to debug the program by observing the execution of instructions. This is called dynamic debugging.

29. What are the tools used for dynamic debugging?

The tools used for dynamic debugging are,

- a. Single step
- b. Register examine
- c. Break point.

30. Write about single step?

The single step key on a keyboard allows to execute one instruction at a time, and to observe the results following each instruction. Generally, a single-step facility is built with a hard-wired logic circuit. When the single step key is pushed, addresses and codes are observed as they are executed.

PART-B& PART-C

1.i) Explain the configuration of PLC.

ii) Give advantages of PLC system over traditional mechanical system.(MAY 2015, MAY 2016)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008 ", Page No: from 311 to 317.

2.Explain the following

a) Registers

b) Counters

c) Internal Relays

d) Timers.

(NOV 2012)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008 ", Page No: from 460 to 472.

3.Explain the basic structure of PLC.(NOV 2017, MAY 2017, MAY 2015, MAY 2014)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008 ", Page No from 431 to 445.

4.Explain the following

a) Registers

b) Counters

c) Internal Relays(NOV 2017, MAY 2017, MAY 2013, MAY 2012, NOV 2012)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008 ", Page No from 409 to 415.

5.Device a PLC circuit for the following application: Consider a conveyor belt that is to be used to transport goods from a loading machine to a packaging area. When item is loaded into the conveyor belt, a contact switch might be used to indicate that the item is on the belt and start the conveyor motor. The motor then has to keep running until the item reaches the far end of the conveyor and falls off into the packaging area. When it does this, a switch might be activating which has the effect of switching of the conveyor motor. The motor is then to remain off until the next item is loaded onto the belt.(MAY 2016)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008 ", Page No from 406 to 409 and from 416 to 421.

6.“Device PLC circuit for the following application : Consider a simple goods lift to move items from one level to another. The lift is to move upwards when a push button is pressed at the ground level to send the lift upwards or a push button is pressed at the upper level to request the lift to move upwards but in both cases there is a condition that has to be met that a limit switch indicates that the access gate to the lift platform is closed.. (MAY 2017)

Refer: "Bolton, "Mechatronics",PrinticeHall,2008 ", Page No: 374 to 380.

UNIT V ACTUATORSAND MECHATRONIC SYSTEMDESIGN

TypesofStepperandServomotors–Construction– WorkingPrinciple–Advantagesand Disadvantages.Design process-stages ofdesignprocess– TraditionalandMechatronicsdesign concepts–Case studies ofMechatronics systems–Pickand place Robot–Engine Management system–Automaticcarparkbarrier.

PART-A**1. Write about the input / output channels?**

The input/output channels provide signal conditioning and isolation functions so that sensors and actuators can be generally directly connected to them without the need for other circuitry. Common input voltages are 5 V and 24V. Common output voltages are 24 V and 240 V.

2. Write about the relay?

With the relay type, the signal from the PLC output is used to operate a relay and so is able to switch

currents of the order of a few amperes in an external circuit. The relay isolates the PLC from the external circuit and can be used for both D.C. and A.C. switching. Relays are, however, relatively slow to operate.

3. What are opto isolators?

Opto isolators are used with transistor switches to provide isolation between the external circuit and the PLC. They are also used to provide isolation.

4. What are the methods used for input / output processing?

There are two methods used for input / output processing. They are

- a. Continuous updating
- b. Mass input/output copying.

5. What is continuous updating?

This involves the CPU scanning the input channels as they occur in the program instructions. Each input point is examined individually and its effect on the program determined. Each input is scanned with a 3 ms delay, before the program has the instruction for a logic operation to be executed and an output to occur. This process is called continuous updating.

6. What is the disadvantage of continuous updating?

Because of the 3 ms delay in the continuous updating on each input, the time taken to examine several hundred input/output points can become comparatively long.

7. Write about the mass input/output copying?

To allow a more rapid execution of a program, a specific area of RAM is used as a buffer store between the control logic and the input/output unit. At the start of each program cycle the CPU scans all the inputs and copies their status into the input/output address in RAM. At the end of each program cycle all the outputs are transferred from RAM to the output channels. The outputs are latched so that they retain their status until the next updating.

8. What is a LATCH circuit?

The term latch circuit is used for the circuit used to carry out such an operation. It is a self – maintaining circuit in that, after being energized, it maintains that state until another input is received. It remembers its last state.

9. Define the term point and delay–on?

The term point is used for a data point and so is a timing, marker (internal relay) or counter element. Thus, the 16 points for timers means that there are 16 timer circuits. The term delay on is used to indicate that this type of timer waits for a fixed delay period before turning on.

10. Write about timer circuit?

A timer circuit is specified by stating the interval to be times and the conditions or events that are to start and / or stop the timer. They are commonly regarded as delays with coils which, when energized, result in the closing or opening of input contacts after some preset time.

11. Write about internal relays?

The term internal relay, auxiliary relay or marker is used for what can be considered as an internal relay in the PLC. These behave like relays with their associated contacts, but in reality are not actual relays with their associated by the software of the PLC. Internal relays are often used when there are programs with multiple input conditions.

12. Write about counters?

Counters are used when there is a need to count a specified number of contact operations. Example – where items pass along a conveyor into boxes, and when the specified number of items has passed into a box the next item is diverted into another box.

13 What is an up counter?

An up counter would count up to the preset value i.e., events are added until the number reaches the set value. When the set value is reached the counters contact changes state.

14. What is a down counter?

Down counter means that the computer counts down from the preset value to zero i.e., events are subtracted from the set value. When zero is reached the counters contact changes state.

15. Write about shift register?

The term shift register is used because the bits can be shifted along by one bit when there is a suitable input to the register.

16. What are the inputs of shift register?

There are three inputs of shift register. They are,

- a. One to load data into the first element of the register (OUT).
- b. One as the shift command (SFT).
- c. One for resetting (RST).

17. What the operations that are carried out with a PLC on data words?

The operations that are carried out with a PLC on data words are,

- a. Moving data
- b. Comparison of magnitudes of data
- c. Arithmetic operations such as addition and subtraction
- d. Conversions between binary coded decimal (BCD), binary and octal.

18. What is the criteria need for the selection of a PLC?

The criteria needed for the selection of a PLC are the following.

- a. Input/output capacity is required.
- b. Types of inputs/outputs are required.
- c. Size of memory required.
- d. Speed and power is required for the CPU.

19. What are the numbers of stages in the design process?

The design process can be considered as a number of stages. They are,

- a. The need
- b. Analysis of the problem
- c. Preparation of a specification
- d. Generation of possible solutions
- e. Selections of a suitable solution
- f. Production of a detailed design
- g. Production of working drawings.

20. What are the advantages of the microprocessor controlled system?

The microprocessor controlled system can cope easily with giving precision and programmed control. The system is much more flexible. This improvement in flexibility is a common characteristic of Mechatronics systems when compared with traditional systems.

21. What is the advantage of using PLC solution over mechanical solution?

A PLC solution could involve the arrangement with the given ladder program. This would have the advantage over the rotating cam of having off and on times which can be adjusted by purely changing the timer preset values in the program whereas a different cam is needed if the times have to be changed with the mechanical solution.

22. What are the axes of a pick and place robot?

The robot has three axes about which motion can occur.

- a. Rotation in a clockwise or counter clockwise direction of the unit on its base.
- b. Arm extension or contraction and arm up or down.
- c. Gripper can open or close.

23. How do the movements of robot take place?

Clockwise rotation of the unit might result from the piston in a cylinder being extended and the counter clockwise direction by its retraction. Likewise the upward movement of the arm might result from the piston in a linear cylinder being extended and the downward motion from it retracting, the extension of the arm by the piston in another cylinder extending and its return movement by the piston retracting.

24. What is the use of PLC in automatic car park system?

An illustration of the use of a PLC in the coin operated barriers for a car park. The in-barrier is to open when the correct money is inserted in the collection box and the out – barrier is to open when a car is detected at the car park side of the barrier.

25. How does a car park barrier works?

When a current flows through the solenoid of valve, the piston in a cylinder moves upwards and causes the barrier to rotate about its pivot and rise to let a car through.

26. Write about the engine speed sensor?

The engine speed sensor is an inductive sensor and consists of a coil for which the inductance changes as the teeth of the sensor wheel pass it and so results in an oscillating voltage.

26. How is the voltage produced by the oxygen sensor?

The oxygen sensor is generally a closed – end tube made of zirconium oxide with porous platinum electrodes on the inner and outer surfaces. Above about 300°C, the sensor becomes permeable to oxygen ions with the result that a voltage is produced between the electrodes.

27. Give some applications of microprocessor.

The examples of the microprocessor are,

- a. Microprocessor Controlled Temperature System (MCTS)
- b. Stepper motor control.
- c. Traffic light controller.

PART-B& PART-C

1. Explain about the mechanical system design of an automatic car park barrier.(MAY 2017, MAY 2011)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No from 488 to 491.

2.Explain about the various functional components in wireless surveillance balloon system.(NOV 2017, MAY 2015, MAY 2013, MAY 2012)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008. ”, Page No from 321 to 335.

3.Discuss the mechatronic design of the pick and place robot with a neat control circuit.(MAY 2016, MAY 2015)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”,Page No from 386 to 391.

4.Explain the design of a mechatronic system used in a engine management system(MAY 2016, MAY 2012, MAY 2011)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No from 526 to 530.

5.Explain with a neat circuit, the control system and the communication system used in the wireless surveillance balloon. (NOV 2011)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008. ”, from Page No 516 to 525.

6.Detail about the various functional components in a wireless surveillance balloon system (NOV 2017, MAY 2017, MAY 2016, MAY 2015)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008. ”, Page No from 497 to 498.

7.Discuss mechatronic design of an automatic car parking system. (NOV 2011)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No from 321 to 330.

8.Discuss the mechatronic design of the pick and place robot with a neat control circuit.(NOV 2011)

Refer: “Bolton, “Mechatronics”,PrinticeHall,2008 ”, Page No from 341 to 343.

CIM QUESTION BANK

UNIT I INTRODUCTION

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production

PART-A

1. List any two reasons for using a CAD system. (Nov/Dec 2011)

- (i) To increase the productivity of the designer
- (ii) To improve the quality of the design.
- (iii) To improve the communications.

2. What are the components of CAD systems? (Nov/Dec 2011)

1. Geometric modeling.
2. Design analysis and optimization,
3. Design review and evaluation and
4. Documentation and drafting

3. What are the drawing features of CAD package? (May/June 2012)

- (i) Geometric modeling features.
- (ii) Editing or manipulation features.
- (iii) Display control features.
- (iv) Drafting features.

4. What are the advantages of CAD modeling? (May/June 2012)

- (i) Mass properties of physical model can be calculated quickly
- (ii) Solid models are unambiguous models.
- (iii) Cross sectional views of models can be obtained easily.
- (iv) It can be used for interference/clearance checking of moving parts

5. What are the functions of a manager/management? (MAY 2012, MAY 2016)

Planning, Organizing, Directing, and Controlling. Some people include additional roles such as Leading, Staffing, Coordinating, etc.

6. List any four rules of dimensioning? (Nov/Dec 2012)

- Each dimension should be given so clearly so that it can be interpreted in only one way.
- Dimensions should not be duplicated.
- Dimensions should be given between points or surfaces that have a functional relation to each other.

- Dimensions should be placed in views where the features dimensioned are shown true shape.

7. Distinguish between reflection and scaling transformations. (May/June 2013)

- Both reflection and scaling involve only diagonal elements of the transformation matrix.
- The magnitude of the diagonal element results into scaling (enlargement or compression) while the sign of the same element will produce reflection.

8. What is sculptured surface? (May/June 2013)

Sculptured surface means the surface produce by combining two families of curves that intersect one another in crises cross manner, creating network of inter connected patches.

9. What are the advantages to be gained by the adoption of CAD? (Nov/Dec 2013)

- Increased design productivity
- Shorter lead time
- Flexibility in design
- Improved design analysis
- Fewer design errors
- Greater accuracy in design calculation.

10. Specify the range of applications for which typical geometric modeling information is used. (Nov/Dec 2013)

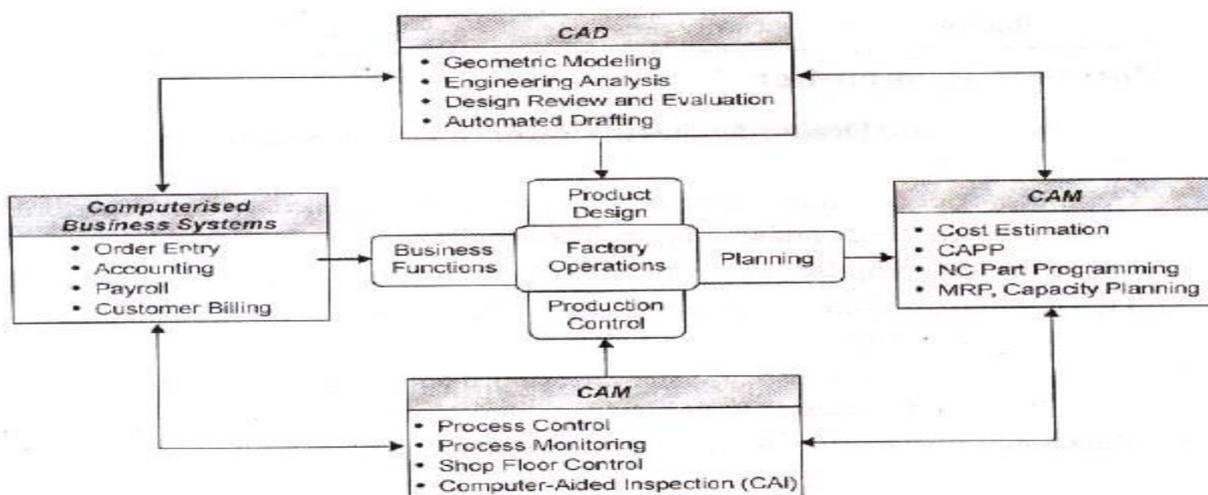
Surface modeling can be used generally to model exterior shell objects like sheet metals works and thin molded plastic parts. Other areas of applications of surface modeling are:

- Body panels of passenger cars, structural components of aircraft and marine structures.
- Plastic containers, telephones, impellers of pump and turbine, development of surface for cutting shoe leather, glass marking.

11. Explain CIM.

CIM is the integration of the total manufacturing enterprise through the use of integrated systems and data communications coupled with new managerial philosophies that improve organizational and personnel efficiency.

12. What are the components of CIM?



13. What are the steps involved in designing and manufacturing a product?

Steps involved in designing and manufacturing a product.

- Definition of product
- Design analysis
- Drifting
- Pilot production
- Inspection
- Packing
- Conceptual design
- Prototype
- Material and process selection
- Production, Quality assurance and Final product

14. What is the role of CIM in manufacturing?

CIM is most closely associated with functions in manufacturing engineering such as process planning and numerical control (NC) part programming.

15. What are important applications of CIM in manufacturing planning?

The applications of CIM can be divided into two broad categories.

- 1) Manufacturing planning
- 2) Manufacturing control

16. What are the important applications of CIM in manufacturing control?

- The applications of computer process control are pervasive today in automated production systems.
- Quality control includes a variety of approaches to ensure the highest possible quality levels in the manufactured product.
- Shop floor control refers to production management techniques.

17. What is management?

Management is the process of making decisions and directing the activities of personnel to achieve stated objective. The objectives are successfully met when efforts are organized by communicating appropriate information for control and readjustment.

18. List out the tasks for the managers in effective management:

The following six tasks for the managers of CIM:

1. Develop a business model to understand the problem environment
2. Develop a functional model for the processes, functions, and activities to describe both "as is" and "to be".
3. Develop an information model that identifies system interfaces, information exchange patterns, database requirements and applicable technologies.
4. Develop a network model to identify communication and networking requirements
5. Develop an organizational model to investigate the implications of integrating the various islands of automation on the existing organization structure and culture, and how to safeguard against detrimental effects.
6. Finally, develop the implementation plan which should take into account special features of the business and operations.

19. What are the major communication used in manufacturing industry?

The major communication used in manufacturing industry

1. Telephones, including cellular systems
2. Facsimile terminals (or) Fax machines
3. Satellite dish and video conferencing
4. Personal computers (PCs)

20. What is videoconferencing?

The videoconferencing is a live, interactive television program delivered through satellite for a special audience. Videoconferencing can encompass several countries. In it, even two or more persons can participate. For example, in a videoconference manufacturing engineers may discuss "live" about the product with the designers who may be located at company headquarters 1000kms away. Occasionally, customers or distributors may be called in "live" to clarify a point relating to the defect.

21. Define automation.

Automation is generally defined as the process of having machines follow a predetermined sequence of operations with little or no human labor, using specialized equipment and devices that performs and control manufacturing processes.

22. What are the goals of automation in manufacturing industry?

Automation has the following primary goals.

- i) Process Integration
- ii) Improve Productivity
- iii) Economize on floor space
- v) Improve quality

23. What are the function of automated manufacturing system?

Automating manufacturing systems operate in the factory on the physical product. They perform operations such as processing, assembly, inspection, or material handling, in some cases accomplishing more than one of these operations in the same systems.

24. Give the classification of automation.

Automated manufacturing systems can be classified into three basic types:

- 1) Fixed automation
- 2) Programmable automation
- 3) Flexible automation.

25. What are the benefits of automation?

- To increase labour productivity
- To reduce labour cost
- To mitigate the effects of labour shortages
- To reduce or eliminate routine and clerical takes
- To improve worker safety.

26. What are the capabilities of computer control?

The capabilities are:

- 1) Polling (or) Data sampling
- 2) Interlocks
- 3) Interrupt system
- 4) Exception handling

27. Explain the types of interlocks.

There are two types of interlocks:

i) Input interlocks ii) Output interlocks

i) Input interlocks: An input interlocks that originates from an external device.

(e.g., a limit switch, sensor, or production machine) and is sent to the controller.

ii) Output interlocks: An output interlock is a signal from sent the controller to same external devises. It is used to control the activities of each external device and coordinate its operation with that of the other equipment in the cell.

28. What is MAP?

Manufacturing Automation Protocol (MAP) is a specialized LAN designed for a factory environment. It is hardware cum-software implement able set of rules that facilitate information transfer among networked computers and computer-based equipment.

29. What are the approaches of physical distributions?

- **Customer service:** What level of customer service should be provided?
- **Transportation:** How will the products be shipped?
- **Warehousing:** Where will the goods be located? How many warehouses should be utilized?
- **Order processing:** How should the order be handled?
- **Inventory control:** How much inventory should be maintained at each location?
- **Protective packing and materials handling:** How can efficient methods be developed for handling goods in the factory, warehouse, and transport terminals?

30. Define lean manufacturing. (Nov/Dec 2011)

Lean manufacturing may be defined as an adaptation of mass production in which workers and work cells are made more flexible and efficient by adapting methods that reduce waste in all form.

PART-B

1. Describe the applications of computers for design. (Nov/dec 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. Explain the drawing features of CAD. (Nov/dec 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

3 .Name the types of modeling of CAD? Explain about any one of them. (Nov/dec 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4. Describe about operator input devices used at the graphics workstation. (May/june2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Explain about the following types of transformations with example. (Nov/dec2012)

(i) Translation (ii) scaling (iii) rotation

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Write the short notes on 3D scaling and 3D shearing geometric transformation. (May/june 2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems

PART-A

1. List any two benefits of CIM (Nov/Dec 2011)

Tangible benefits	Intangible benefits
<ul style="list-style-type: none">• Higher profits• Improved quality• Shorter time to market with new products• Shorter flow time• Shorter vendor lead time	<ul style="list-style-type: none">• Improved customer service• Greater flexibility• Greater responsiveness• Improved competitiveness• Safer working environment• Higher employee morale

2. What are the various network topologies? (Nov/Dec 2011)

The five basic network topologies are:

(i) Star, (ii) Tree, (iii) Bus, (iv) Ring, (v) Hybrid

3. What is the difference between automation and CIM? (May/June 2012)

Automation may be defined as the process of having machines follow a predetermined sequence of operations with little or no human labor, using specialized equipment and devices that perform and control manufacturing process. CIM is the automated version of the manufacturing process where the three major manufacturing functions—product and product design, production planning and control, and production process—are replaced by the automated technologies. In fact, CIM represents the logical evolution of the automation concept.

4. What is meant by asynchronous data transfer? (Nov/Dec 2012)

In asynchronous data transfer, data is sent one byte (or one character) at a time. Each string of bits making up the byte is bracketed, or marked off, with special control bits.

5. Differentiate between LAN model and MAN model. (Nov/Dec 2012)

- A local area network is a privately owned communications network that serves users within a confined geographical area.
- A metropolitan area network is a communication network covering a geographic area of the city or suburb.

6. What is a communications network? List its types. (May/June 2013)

- A communications network is a collection of equipment and physical media that interconnects two or more computers.
- Three categories of networks are:
 - (i) Local area networks (LANs)
 - (ii) Metropolitan area network (MANs)
 - (iii) Wide area networks (WANs)

7. What is the MAP model? (May/June 2013)

Both goal and objective can be defined as statements that reflect the end towards which the organization is aiming to achieve. However, there are significant differences between the two. A goal is an abstract and general umbrella statement, under which specific objectives can be clustered. Objectives are statements that describe—in precise, measurable, and obtainable terms which reflect the desired organization's outcomes.

8. Differentiate IGES and GKS graphic standards. (Nov/Dec 2013)

- Graphical kernel system (GKS) is a device independent graphics language for 2D, 3D and bitmapped graphics images. It allows graphics applications to be developed on one system and easily moved to another with minimal or no change.
- Initial graphic exchange specifications (IGES) is the most comprehensive standard and designed to transmit the entire product definitions including that of manufacturing and any other associated information.

9. Differentiate modulation and demodulation. (Nov/Dec 2013)

- The process of changing some characteristics (e.g. amplitude, frequency or phase) of a carrier

wave in accordance with the intensity of the signal is known as modulation.

- The process of recovering the audio signal from the modulated wave is known as demodulation.

10. Define Group Technology (GT).

Group Technology (GT) is a manufacturing methodology in which identical or similar components grouped processed together during design, process planning and manufacturing so that a wide variety of components can be manufactured, at the least expense of time, inventory, man hours and material handling.

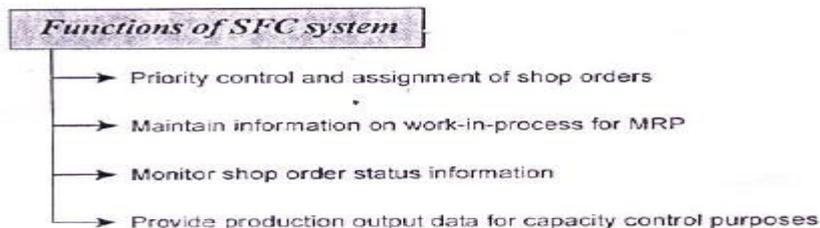
11. List out the stages in Group Technology.

- a) Production planners to setup the GT database.
- b) Grouping the parts or components into part-families with some similar characteristics.
- c) Re-design the shop-floor arrangement according to common shape, function or manufacturing process and tooling.

12. Define Part families.

Part-family is defined as "collection of parts which are similar in terms of geometric shape, size, and similar processing steps required in manufacturing, so flow of materials through the plant improves".

13. What are the methods available for solving problems in GT?



14. Explain the two categories of attributes of parts.

- 1) Design attributes, which are concerned with part characteristics such as geometry, size, and material.
- 2) Manufacturing attributes, which consider the sequence of processing steps required to make a part.

15. List out the premises for the developed of DCLASS code.

- i) A part may be best characterized by its basic shape, usually is most important attribute.
- ii) A Each basic shape may have several features, such as holes, slots, threads and grooves.
- iii) A part can be completely characterized by basic shape; size; precision and material type, form and condition.
- iv) Several short code segments can be linked to form classification code that is human recognizable and adequate for human monitoring.
- v) Each of these code segments can point to more detailed information

16. What is PFA?

Production flow analysis is a technique for pre-planning the division of the whole factory into groups or departmental groups. When the knowledge of division is available, then it is possible to plan the layout.

17. What is the weakness of PFA?

The weakness of production flow analysis (PFA) is that the data used are derived from production route-sheets. But the process-sequences have been prepared by different process planners and the difference is reflected on to these route-sheets.

18. What are the applications of GT?

1. **Design:** In a firm many components have similar shape. They can be grouped into design families and a design can be created by simply modifying an existing component design from the same family.
2. **In Manufacturing:** For this purpose GT gives a great importance than simply a design philosophy. Parts that are not similar in shape may still need similar manufacturing processes. Parts of this type are called production family. (All parts may need same operation like drilling, milling thread cutting etc.)
3. **Process Planning:** Process planning work can be facilitated as similar processes are needed for all components of a particular family.

This helps production planning and control much easier because only similar parts are considered for each cell. Such a cell-oriented layout is called a group technology layout or cellular layout.

19. What is FMS?

FMS is a manufacturing system based on multi-operation machine tools, incorporating (automatic part handling and storage).

20. What is Process planning?

Process planning consists of preparing a set of instructions that describe how to fabricate a part or build an assembly which will satisfy engineering design specifications.

Process planning is the systematic determination of the methods by which product is to be manufactured, economically and competitively.

21. What are the results of Process Planning?

Routings which specify operations, operation sequences, work centers, standards, tooling and fixtures. This routing becomes a major input to the manufacturing resource planning system to define operations for production activity control purpose and define required resources for capacity requirements planning purposes.

*Process plans which typically provide more detailed, step-by-step work instructions including dimensions related to individual operations, machining parameters, set-up instructions, and quality assurance checkpoints.

*Fabrication and assembly drawings to support manufacture (as opposed to engineering drawings to define the part).

22. What are the steps involved in Process planning?

Steps involved in Process Planning

- i) Preliminary analysis and Product design evaluation
- ii) Selection of manufacturing process
- iii) Selection of Machine Tool
- iv) Selection of Tooling and Process parameters
- v) Final operation sequence selection

23. What are the factors should be considered in selection of tooling?

- The type and amount of the material to be cut
- The surface finish required
- The rigidity and shape of the part.
- The capacity and condition of the available equipment
- The required production volume (high volume jobs usually permit optimum speeds and feeds while lot jobs may use lower speeds to achieve completion of the lot without regrinding of the cutting tool)

24. What are the principles should adhere while determining the efficient sequence?

- The first operation in the sequence should be one in which the largest layer of metal is removed.
- Finishing operations should be performed at the end of the operation sequence.
- * Surfaces whose machining does not greatly affect the rigidity of the work should be machined earlier in the sequence, and
- * The sequence of machining operations should be coordinated with heat treating operations, if any in the processor manufacture.

25. What are the prerequisites for process planning?

The other prerequisites for process planning are:

- * Part list" Annual demand/ batch size
- * Accuracy and surface finish requirement
- * Equipment details
- * Data on cutting fluids, tools, jigs and fixtures, gauges.
- * Standard available stock sizes.
- * Machining data, data on handling and setup.

26. What are the approaches the CAPP will recognize?

Two approaches to CAPP are traditionally recognized: the variant approach and the generative approach. Many CAPP systems combine both approaches.

27. Why CAPP systems are called as variant system?

The main reasons probably are:

1. The investment is less and the development time is shorter. Especially for medium sized companies which want to establish their own research groups.
2. The development costs and hardware costs are lower. Especially for some small companies where the products do not vary much and who still have process planners.

28. Give the main component of generative CAPP systems.

CAPP system contains of two main components.

- i) Manufacturing data base (part description, machine tool library etc.)
- ii) Decision logic (to represent the process planner)

29. What are the benefits of CAPP over manual process?

1. **Process rationalization:** Computer-automated preparation of operation routings is more likely to be consistent, logical, and optimal than its manual counterpart. The process plans will be consistent because the same computer software is being used by all planners.
2. **Increased productivity of process planners:** With computer-aided process planning, there is reduced clerical effort, fewer errors are made and the planners have immediate access to the process planning database. These benefits translate into higher productivity of the process planners.
3. **Reduced turnaround time:** Working with the CAPP system, the process planner is able to prepare a route sheet for a new part in less time compared to manual preparation. This leads to an overall reduction in manufacturing lead time.
4. **Improved legibility:** The computer-prepared document is neater and easier to read than manually written route sheets. CAPP systems employ standard text, which facilitates interpretation of the process plan in the factory.
5. **Incorporation of other application programs:** The process planning system can be designed to operate in conjunction with other software packages to automate many of the time-consuming manufacturing support functions.

30. Define agile manufacturing. (May/June 2012)

Agile manufacturing is (i) an enterprise level manufacturing strategy of introducing new products into rapidly changing markets, and (ii) an organizational ability to thrive in a competitive environment characterized by continuous and sometimes unforeseen change.

PART-B& PART-C

1. Explain the open system interconnection architecture (OSI) formulated by ISO. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. What are the different network topologies available? Discuss them in detail. (Nov/dec2013)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11..

3. Explain the important of CIM. Also write the reasons for implementing CIM. (May/June 2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4. Explain and compare the different types of network topologies. (Nov/dec2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited,

3rd Edition, 2008.”, Page No:9

5. Brief the significance the MAP in CIM environment. (Nov/dec2013)

Refer: “Radhakrishnan.P, Subramaniyan.S andRaju.V “Cad/Cam/Cim”, New Age International (P) Limited, 3rd Edition, 2008.”, Page No:9

6. Explain the open system interconnection with CAPP. (May/June 2013)

Refer: “Radhakrishnan.P, Subramaniyan.S andRaju.V “Cad/Cam/Cim”, New Age International (P) Limited, 3rd Edition, 2008.”, Page No:9

UNIT III CELLULAR MANUFACTURING

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems

PART-A

1. State the role of GT in CAD/CAM integration. (Nov/Dec 2011)

GT applications provide a common database for effective integration of CAD and CAM, which leads to successful implementation if CIM. For the effective integration of CAD and CAM, one needs to integrate the information used by all the departments in a shop such a design, manufacturing, quality, etc. GT provides the much needed common language for the users. It gives a means to structure and save information about parts, such a design and manufacturing attributes, processes, and manufacturing capabilities.

2. List any two benefits of CAPP (Nov/Dec 2011)

- Process rationalization and standardization
- Productivity improvement
- Product cost reduction
- Elimination of human error
- Reduction in time

3. Mention the benefits of GT. (May/June 2012)

- GT results in product design
- GT results in reduced materials handling cost because of the group layout of the shop
- GT simplifies production and inventory control activities
- GT leads to an automated process planning system

4. What is CAPP? (May/June 2012)

CAPP refers to computer aided process planning it is used to overcome the drawbacks of manual process planning. With the use of computers in the process planning, one can reduce the routine clerical work of manufacturing engineers, also it provides the opportunities to generate rational, consistent and optimal plans.

5. What is mean by mono code and poly codes structures? (Nov/Dec2012)

- In mono codes (or hierarchical code), the interpretation of each successive symbol depends on the value of the proceeding symbols
- In poly codes (or attributes codes), the interpretation of each symbol in the seconds does not depends on the value of proceeding symbols

6. List out the technique available for formation of cell in GT. (Nov/Dec2012)

7. What is the main difference between hierarchical codes and attribute codes structures?(May/June 2013)

In hierarchical structure, the interpretation of each symbol in the sequence depends on the value of preceding

symbols. Whereas in attributes/polycode structure, the interpretation of each symbol in the sequence does not depend on the value of preceding symbols.

8. What is CMPP system? (May/June 2013)

The CMPP stands for computer managed process planning. It is a commercial generative process planning system capable of automatically making process decisions.

9. Explain Opitz coding system.

- The Opitz coding system uses alpha numeric symbols to represent the various attributes of a part.
- The Opitz coding scheme uses the following digit sequence: 12345 6789 ABCD
- The first five digits (12345) code the major design attributes of a part and are called the “form code”. The next four digits (6789) are for coding manufacturing related attributes and are called the “supplementary code”. The letters (ABCD) code the production operation and sequence and are referred to as the “secondary code”.

10. Define Group technology.

It is a manufacturing philosophy to increase production efficiency by grouping a variety of parts having similarities of shape, dimensions, and/or process route.

11. Gives the major objectives of Production Management Systems (PMS).

The two major objectives of a production management system (PMS) are planning and controlling of the manufacturing operations. The Planning Stage deals initial Production planning, development of master schedule, capacity planning, and MRP.

12. Define SFC.

Shop Floor Control (SFC) is defined as the important manufacturing activity that will control flow of the product and materials on the factory floor involving the quantities, types of parts, schedule dates, priorities and the status of jobs and orders.

13. What are the primary functions of SFC?

Functions of SFC system

- Priority control and assignment of shop orders
- Maintain information on work in process for MRP
- Monitor shop order status information
- Provide production output data for capacity control purposes

14. What are the phases of SFC?

The three phases or modules are:

1. Order Release
2. Order Scheduling
3. Order Progress

15. What is the purpose of FDS?

The purpose of the Factory Data Collection (FDS) system in shop floor control is to provide basic data for monitoring order progress. In a computerized SFC system these data are submitted to the order progress module for analysis and generation of work order status reports and exception reports.

16. What is an Automatic Data Capture (ADC) method?

Automatic Identification methods is also known as Automatic Data Capture (ADC) it refers to the technologies that provides direct entry of data into the computer or other control systems without using a keyboards. These technologies require no human involvement in the data capture and entry process.

17. What are the technologies used in ADC?

1. Optical
2. Magnetic type
3. Electromagnetic type
4. Smart card
5. Touch techniques
6. Biometric

18. What Bar code consists?

The bar code consists of a thick and narrow colored bars separates thick and narrow spaces separating the bars. The pattern of bars and spaces is co to represent alphanumeric characters.

19. What are the types of Bar code?

Bar codes divide into two basic types:

- 1) Linear, in which the encoded data are read using a linear sweep of the scan
- 2) Two-dimensional, in which the encoded data must be read in both directions

20. What is DAS?

A data acquisitions system (DAS) is a computer system used to automatically collect data from a process or piece of equipment. They either perform an analysis of the data or transmit the data to another computer for processing and analysis.

21. List out the application of ADC technology.

The following are the most common applications of ADC technologies.

- 1) Parts receiving
- 2) Shipping
- 3) Order picking
- 4) Finished goods storage
- 5) Manufacturing processing
- 6) Work-in-process storage
- 7) Assembly

22. What are the types of SFC?

The types of SFC data that would be collected by the FDC system include

- Labor time turned in against a job
- Count on scrapped parts or needing rework.
- Piece counts
- Machine breakdowns.
- Completion of operations in the routing sequence.

23. Define FMS.

A Flexible Manufacturing System (FMS) is an individual machine or group of machines served by an automated materials handling system that is computer controlled and has a tool handling capability.

24. What are the Objectives of FMS?

- To provide flexible manufacturing facilities for a family of components.
- To provide the benefits of grouping the operation in a single location.
- To provide the flexibility in producing small and medium parts.
- To maximize the utilization of facilities.
- To have a good management control.

25. What are the components of FMS?

Flexible Manufacturing Systems (FMS) consists of the following four components.

1. Processing stations or workstations
2. Material handling and storage
3. Computer control system
4. Human labor

26. What are the FMS layout configurations?

FMSs can be divided into five categories

- 1) In-line layout
- 2) Loop layout
- 3) Ladder layout
- 4) Open field layout
- 5) Robot-centered cell.

27. What are the functions of computers in FMS?

The functions of computers in FMS

1. Workstation control
2. Distribution of control instructions to workstations
3. Production control
4. Traffic control
5. Shuttle control
6. Work piece monitoring

- 7. Tool control
- 8. Performance monitoring and reporting
- 9. Diagnosis

28. List the applications of FMS.

Applications of FMS installations are in the following areas.

- Machining
- Assembly
- Sheet-metal press-working
- Forging
- Plastic injection molding
- Welding
- Textile machinery manufacture
- Semiconductor component manufacture

29. Give the benefits of FMS.

The benefits that can be expected from an FMS include

- Increased machine utilization
- Fewer machines required
- Reduction in factory floor space required
- Greater responsiveness to change
- Reduced inventory requirements
- Lower manufacturing lead times
- Reduced direct labour requirements and higher labor productivity
- Opportunity for unattended production

30. List any two advantages and disadvantages of FMS implementation.

Advantages

- Faster, lower-cost changes from one part to another which will improve capital utilization.
- Lower direct labor cost, due to the reduction in number of workers.

Disadvantages

- Substantial pre-planning activity.
- Expensive, costing millions of dollars.

31. How does FMS classified based on level of flexibility?

FMS classified based on level of flexibility as,

- Production flexibility
- Machine flexibility
- Mix flexibility
- Product flexibility

PART-B& PART-C

1. Explain about Optiz classification and coding system. (Nov/dec2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

2. Explain retrieval and generative CAPP systems. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

3. Briefly discuss the various benefits of implementing a GT in a firm. Also bring out the advantages and

limitations of using GT. (Nov/dec2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

4.(a) Describe the composite part concept in cellular manufacturing.

(b)Discuss the importance of process planning in product development .(May/June 2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Briefly write about i) Composite part concept &ii) Key machine concept. (May/June 2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Explain why the GT is important in achieving CAD&CAM integration? (Nov/dec2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

PART-A

1.Mention any two methods used to collect data from the shop floor.(Nov/Dec 2011)

➤ **Manual/clerical data input techniques**

- (i) Job traveler
- (ii) Employee time sheet

➤ **Data collection terminals**

- (i) Push button keyboards
- (ii) Keyboard based terminals

➤ **Automated input techniques**

- (i) Optical bar code readers
- (ii) Magnet card readers

2. Write any two applications of FMS.(Nov/Dec 2011)

- (i) Machining (ii) assembly (iii) sheet metal press working
- (iv) Forging (v) plastic injection moulding (vi) welding (vii) textile machinery manufacture and (viii) semi conductor component manufacture.

3. State the functions of computer control system of FMS. (May/June 2012)

- Workstation/ processing station control
- Distribution of control instructions to work stations
- Production control
- Material handling control system

4. List the different stages of shop floor control. (May/June 2012)

- (i) Order release
- (ii) Order scheduling
- (iii) Order progress

5. Differentiate between dedicated FMS and random order FMS. (Nov/Dec 2012)

A dedicated FMS is defined to produce a limited variety of part configurations. The random order FMS is more flexible (capable of producing large variety of parts) than the dedicated FMS.

6. State the purpose of primary and secondary material handling system. (Nov/Dec 2012)

- The primary handling system establishes the basic layout of the FMS and is responsible for moving work parts between workstation in the system.
- The secondary handling system transfers work parts from the primary system to the machine tool or other processing system.

7. Distinguish between on line and off line data collecting systems. (May/June 2013)

- In on line system, the data are entered directly into the plant computer system and are immediately available to the order to the progress module.
- In off line system, the data are collected temporarily in a storage device or a stand alone computer system to be entered and processed by plant computer in a batch mode.

8. List some important advantages of implementing FMS. (May/June 2013)

- Increased machine utilization
- Reduced inventory
- Reduced manufacturing lead time
- Greater flexibility in production scheduling
- Shorter response time

9. Mention the importance of shop floor control system (SFC). (Nov/Dec 2013)

- The release of production orders to the factory
- Monitoring and controlling the progress of the orders through the various work centres, and
- Acquiring information on the status of the orders.

10. What are the inputs and output of MRP? (Nov/Dec 2013)

The three major inputs to MRP are:

- Master production scheduling
- Bill of materials file and
- Inventory record file

11. Which is ideal state in computer based manufacturing applications?

Computer Integrated Manufacturing (CIM) is an ideal state in which computer based manufacturing applications communicate information to coordinate design, planning and manufacturing processes.

12. Draw simple E-R diagram.



13. What are the types of IDEF models?

IDEF	0	Function Modeling (It shows the overall high-level activities of the process)
	1	Information Modeling (It captures conceptual views of the industry information)
	1X	Data Modeling (It captures of logical view of industrial data based on ER model)
	2	Simulation Model design (It represent time varying behavioral of resources in a factory)
	3	Process description capture (It captures physical aspects of a factory system)
	4	Object-oriented design (It captures application of computer language in part design stage)
	5	Ontology description capture (It capture initial specification of the parts in a factory)
	6	Design rationale capture (It represents various design attributes about the parts)
	7	Information system auditing (It captures component manufacturing auditing parameters)
	8	User interface modeling (It represents description about the interfacing methods in factory)
9	Scenario driven IS diagram (It represents all the inputs status in factory)	
10	Implementation modeling (It captures all the implementation methods in part manufacturing)	

14. Write about CIMOSA.

CIMOSA defines a model-based enterprise engineering method which categorizes manufacturing operations into Generic and Specific (Partial and Particular) functions.

15. How CIMOSA separates functions?

- The CIMOSA Modeling Framework in which specific and Generic functions are-clearly separated.
- The CIMOSA Integrating Infrastructure supporting execution of Generic functions and linking specific functions. It is effectively the communication system which interconnects all of the functions in the CIM system.

16. Explain about MRR

The material requirements planning (MRP) function takes current inventory levels for all components needed for the final products (a plant might have 20000 part numbers and perhaps 100 final products for which master schedules have been determined) as well as the components bills of materials and lead time information (obtained from design and process planning] and evolves component master schedules for all components needed by the demand requirements agreed upon. MRP does not take into account whether manufacturing has sufficient capacity to handle the job releases, and so capacity planning evaluates shop loading in terms of the requirements and feeds back to the master schedule for corrective action if problems occur. A further function of MRP based on such analysis is determining whether components should be produced in-house or subcontracted to outside vendors.

17. What is the role of process planning in CIM architecture?

The process planning function can ensure the profitability or non profitability of a part being manufactured because of the myriad ways in which a part can be produced.

18. What is dispatching?

Dispatching is the function of releasing all required items needed to perform an operation on a part so that part production may be accomplished at the time planned by the scheduling function.

19. What about shop-floor information?

Shop-floor information system is responsible for getting the required information down to the processing equipment local controllers and sequencing controllers as well as capturing real-time status data from the equipment and parts so that the feedback loops can effect corrections or normal continuation of operation as required.

20. Explain PDM.

Product Data Management (PDM) or Product Information Management (PIM) systems provide the tools to control access to and manage all product definition data. It does this by maintaining information (meta-data) about product information. Product Data Management (PDM) systems, when tightly integrated with other product development tools does this transparently and with minimal additional effort on the part of the user.

21. List different types of production monitoring system.

Three types production/ process monitoring systems are:

- Data acquisition systems
- Data logging system
- Multilevel scanning

22. What are the inputs to MRP system? (May/June 2012)

- Master production schedule
- Bill of material file
- Inventory record file

23. Write down three phases of shop floor control.(Nov/Dec 2012)

- (i) Order release,
- (ii) Order scheduling
- (iii) Order progress

24. What is meant by procurement lead time?(Nov/Dec 2012)

The procurement lead time is the interval (usually in months) between the initiation of procurement action and the receipt into the supply system of the material produced.

25. What is meant by fixed order quantity model? (Nov/Dec 2013)

In fixed order quantity model, the size of the order (i.e, order quantity) is predetermined fixed, but the time of its placement (i.e, ordering time) is allowed to vary depending upon the fluctuation of demand.

26. What is foreign key?

A key used in one table to represent the value of a primary key in a related table. While primary keys must contain unique values, foreign keys may have duplicates. For instance, if we use student ID as the primary key in a Students table (each student has a unique ID), we could use student ID as a foreign key.

27. What is normalization?

The process of structuring data to minimize duplication and inconsistencies. The process usually involves breaking down a single table into two or more tables and defining relationships between those tables. Normalization is usually done in stages, with each stage applying more rigorous rules to the types of information which can be stored in a table.

28. Mention the different levels of data modelling.

The Data structures are created within a database. The extent of the relationships among them, plays an important role in determining the effectiveness of DBMS. Therefore the database design becomes a crucial activity in the database environment. The task of Database design is made simpler when data models are used. Models are "Simplified abstractions of real-world events or conditions".

For example, such abstractions will enable us to explore the characteristics of entities and the relationships that can be created among such entities. If the models are not logically sound, the database designs derived from them will not deliver the database system's promise of effective information drawn from an efficient database.

29. What is Network Data Model?

A network data model is simply a graph wherein nodes represent unique records, and links between nodes represent association between the corresponding records.

30. What is Hierarchical Data Model?

The hierarchical data model is similar to the network data model except that the relationships among the records are represented in the form of tree structure.

PART-B& PART-C

1. Explain various components of FMS? And list out applications, advantages, disadvantages of FMS. (Nov/dec2011, May/June2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

2. What is shop floor control? And what are the functions of SFC? Explain various phases of SFC. (Nov/dec2011)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

3. Explain the FMS Layout and its application and benefits. (Nov/dec2012, Nov/dec2013)

Refer: "Mikell P.Groover, "Automation,Production Systems,and CIM", Prentice- Hall, 1987", Page No from 6 to 7 and from 10 to 11.

4.Explain about FMS workstation.(May/June2012)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

5. Discuss the technology behind automated data collection system. (Nov/dec2013)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9

6. Explain the FMS Layout and SFC flow control. (Nov/dec2011)

Refer: "Radhakrishnan.P, Subramaniyan.S andRaju.V "Cad/Cam/Cim", New Age International (P) Limited, 3rd Edition, 2008.", Page No:9.

UNIT V INDUSTRIAL ROBOTICS

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems

PART-A

1. Define an Industrial Robot.

An industrial robot is an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes. A programmable mechanical device is used in place of a person to perform dangerous or repetitive tasks with a high degree of accuracy

2. Define base and tool Coordinate system? (Nov 2015) (Nov 2012)

A tool coordinates definition system capable of easily obtaining a transformation matrix for defining a tool coordinates system of a robot. The tool coordinates system at the 0° position of the robot is rotated around each axis so that the tool coordinates system becomes parallel to a base coordinates system

3. What are the rules of Robotics? Write any two laws of robotics. (May/june 2014)

Rules: 1.Do not harm human being 2. Obey human being 3. Protect itself from harm.

Laws: 1.Law zero: A robot may not injure humanity, or, through inaction, allow humanity to come to harm. 2. Law One: A robot may not injure a human being, or through inaction, allow a human being to come to harm, unless this would violate a higher order law. 3.Law Two: A robot must obey orders given it by human beings, except where such orders would conflict with a higher order law. 4.Law Three: A robot must protect its own existence as long as such protection does not conflict

4. Why are robots used?

- a) To reduce production rates – Fast, Accurate, Difficulties in human nature
- b) To avoid 3-d jobs – Dirty, Dangerous, Difficult

5. What is meant by Robot anatomy?

Study of structure of robot is called robot anatomy. Manipulator is constructed of a series of joints and links. A joint provides relative motion between the input links and the output link. Each joint provides the robot with one degree of freedom

6.Mention the classification of robots? (May 2014) (May 2013)

- (i)Physical configuration – 1. Cartesian coordinate configuration 2. Cylindrical coordinate configuration 3. Polar or spherical coordinate configuration 4.Jointed arm configuration 5. Selective Compliance Assembly Robot Arm (SCARA)
- (ii)Control system – 1.Point to point robots 2. Straight line robots 3. Continuous robot
- (iii)Movement – 1.Fixed 2.Mobile 3.Walking or legged robot
- (iv)Types of drive – 1.Pneumatic drive 2.Hydraulic drive 3.Electric drive
- (v)Application –1.Manufacturing 2.Handling 3.Testing
- (vi)Degrees of freedom 1.Single degree of freedom 2.Two 3.Three 4.Six degrees of freedom.

7. What are the benefits of industrial robots?

- Increased Productivity
- Significant Savings
- Improved Quality
- Better Safety
- Competitive Edge

8. Name the important specifications of an industrial robot. (Nov 2012)

- Accuracy

- Repeatability
- Degree of Freedom
- Resolution
- Envelope.

9. What is meant by accuracy of robot?

The robot's ability to reach a reference point within the robot's full work volume is known as accuracy of robot.

10. What is repeatability of robot?

Repeatability refers to robot's ability to return to the programmed point when it is commanded to do so.

11. Define End effector. Give some examples of Robot End Effector.

End effector is a device that is attached to the end of the wrist arm to perform specific task. Examples of Robot End Effector:

- Gripper
- Tools
- Welding equipment
- End of arm Tooling (EOAT)

12. What is meant by Gripper? What are the types of grippers?

Gripper is the End effector which can hold or grasp the object. Types of grippers are 1.Mechanical 2.Collect 3.Vaccum 4.Fragile object 5. Magnetic (i) permanent (ii) Temporary Grippers 6.Pneumatic.

13. List out the gripper design considerations?

1. Material specification 2. Part specification 3. Performance specification 4. Source specification 5. Position specification 6. Environment specification.

14. What are the methods of robot programming? (or) List out four methods of entering commands into the robot controller memory. (Nov 2014)

- On-line programming
- Lead through programming
- Textual robot languages
- Walk-through programming
- Mechanical programming
- Task programming
- Off-line programming

15. What are the ways of accomplishing lead through programming?

- Powered Lead through
- Manual Lead through

16. What are the components of DDC? (Nov/Dec 2011)

- Transducer , sensors, and associated instrumentation
- Actuators (process interface devices)
- Digital computer
- Analog to digital convertor (ADC)
- Digital to analog convertor (DAC)
- Input and output multiplexers

17. What is direct digital control? Nov/Dec 2013

Direct digital control is a computer process control system in which certain components in a conventional analog control system are replaced by the digital computer.

18. Describe CIM data transmission methods.

- The transmission of binary data across a link can be accomplished either in parallel mode or serial mode,

- In parallel mode multiple data are sent with each clock pulse, while, in serial method, one bit is sent with each clock pulse.

19. What are the two types of channel?

Two basic channel types are used in data communications. They are

- i) Analog type ii) Digital type

20. List the characteristics of channel.

The channel characteristics are

- i) Electronic noise ii) Signal attenuation
iii) Analog channel capacity iv) Digital channel capacity

21. What is channel bandwidth?

An analog signal can vary from a minimum to maximum frequency. The difference between the lowest and the highest frequency of a single analog is the bandwidth of that signal. The mathematical formula for frequency is,

$$\text{Frequency} = \frac{\text{Velocity}}{\text{Wavelength}}$$

22. What are two types of transmission mode?

There are three transmission modes available. They are

- i) Simplex ii) Half-duplex iii) Duplex.

They can be applied to both analog and digital channels.

23. What is modulation?

The process of varying amplitude or frequency or phase of the carrier signal in accordance with the instantaneous value of the information signal is known as modulation.

24. What is demodulation?

The process of separating the original information signal from the modulated carrier signal is known as demodulation. It is the inverse process of modulation.

25. What are the reasons for using LAN?

1. LAN allows for decentralization of various data processing functions.
2. LAN allows departments to share hardware.
3. LAN allows for the electronic transfer of text.
4. LAN allows for communication between organizations.
5. LAN allows information to be shared.

26. What are the features of LAN?

- i) Compatibility ii) Protected Mode Operation
iii) Internetworking iv) Growth Path and Modularity
v) System Reliability

27. Define topology and explain its classification.

The pattern of interconnection of nodes in a network is called topology. Topology can also be defined as the geometric arrangement of workstations and the links among them.

The types of LAN topology are i) Bus topology ii) Ring topology iii) Star topology iv) Mesh topology

28. What are the Advantages of LAN?

- LAN is suited to any type of application.
- It provides data integrity.
- Any number of users can be accommodated.
- A LAN can fit any site requirements.
- It is flexible and growth-oriented.
- LAN provides a cost-effective multi user computer environment.
- Data transfer rates are above 10 Mbps.
- It allows sharing of mass central storage and printers.
- It allows file/record locking.

29. Define OSI.

Open systems interconnection (OSI) reference model is an international standards organization (ISO) standard that specifies the conceptual structure of systems that are to communicate with each other.

30. List out the layers of OSI model.

Seven layers in OSI model

- i) Physical layer
- ii) Data link layer
- iii) Network layer
- iv) Transport layer
- v) Session layer
- vi) Presentation layer
- vii) Application layer

PART-B& PART-C**1. Explain about Robot Anatomy and Related Attributes. . (Nov/dec2013)**

Refer: “Radhakrishnan.P, Subramaniyan.S andRaju.V “Cad/Cam/Cim”, New Age International (P) Limited, 3rd Edition, 2008.”, Page No:9

Refer: “Mikell P.Groover, “Automation,Production Systems,and CIM”, Prentice- Hall, 1987”, Page No from 6 to 7 and from 10 to 11.

2. Explain about Robot Control systems. (Nov/dec2013)

Refer: “Radhakrishnan.P, Subramaniyan.S andRaju.V “Cad/Cam/Cim”, New Age International (P) Limited, 3rd Edition, 2008.”, Page No:9

3. Explain about End Effectors – Sensors in Robotics. (May/June2012)

Refer: “Radhakrishnan.P, Subramaniyan.S andRaju.V “Cad/Cam/Cim”, New Age International (P) Limited, 3rd Edition, 2008.”, Page No:9

4.Explain about Robot Accuracy and Repeatability. (May/June 2012)

Refer: “Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.”, Page No from 526 to 530.

5. Explain about Industrial Robot Applications. (Nov/dec 2011)

Refer: “Mikell P.Groover, “Automation,Production Systems,and CIM”, Prentice- Hall, 1987”, Page No from 6 to 7 and from 10 to 11.

6. Write shortly on Robot Part Programming . (May/June2012)

Refer: “Radhakrishnan.P, Subramaniyan.S andRaju.V “Cad/Cam/Cim”, New Age International (P) Limited, 3rd Edition, 2008.”, Page No:9

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DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK



VII SEMESTER

ME6010 – ROBOTICS

Regulation – 2013

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

SUBJECT : ME6010– ROBOTICS

YEAR /SEM: IV /VII

UNIT I FUNDAMENTALS OF ROBOT				
Robot – Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification – Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions - Need for Robots -Different Applications				
PART – A				
CO Mapping : C706.1				
Q.No	Questions	BT Level	Competence	PO
1	Define a Robot?	BTL-1	Remembering	PO2,PO3
2	Define automation?	BTL-1	Remembering	PO1,PO4,PO12
3	List out the types of automation?	BTL-1	Remembering	PO2,PO4
4	Mention the benefits of industrial automation systems?	BTL-5	Evaluating	PO2,PO3
5	What is meant by Robotics?	BTL-1	Remembering	PO1,PO2
6	What are the rules of Robotics? Write any two laws of robotics.	BTL-1	Remembering	PO1,PO2
7	Why are robots used?	BTL-1	Remembering	PO1,PO3
8	What is meant by Robot anatomy?	BTL-1	Remembering	PO1,PO2
9	List out the types of joint notation?	BTL-1	Remembering	PO1,PO2,PO3
10	Mention the classification of robots?	BTL-1	Remembering	PO1,PO3
11	What are the benefits of industrial robots?	BTL-2	Understanding	PO1,PO2,PO12
12	Name the important specifications of an industrial robot.	BTL-1	Remembering	PO2,PO3
13	What is meant by accuracy of robot?	BTL-1	Remembering	PO1,PO3
14	What is repeatability of robot?	BTL-1	Remembering	PO1,PO2
15	What is meant by resolution (precision)?	BTL-1	Remembering	PO1,PO2,PO12

16	List out the types of path control?	BTL-1	Remembering	PO1,PO2
17	List out the robot major components?	BTL-1	Remembering	PO1,PO3,PO4
18	What are the types of robot movements?	BTL-1	Remembering	PO1,PO2
19	What is meant by pitch, yaw and roll?	BTL-1	Remembering	PO1,PO12
20	What is work volume? What is meant by Work space?	BTL-1	Remembering	PO1,PO2
21	Define the term work envelop.	BTL-1	Remembering	PO1,PO2,PO12
22	What is meant by Quality of robot?	BTL-5	Evaluating	PO2,PO12
23	What are the three degrees of freedom associated with the arm and body motion?	BTL-1	Remembering	PO1
24	Define an Industrial Robot.	BTL-1	Remembering	PO1,PO12
25	Define payload capacity of Robot.	BTL-1	Remembering	PO1,PO12
26	Define base and tool Coordinate system?	BTL-2	Understanding	PO1,PO8,PO11
27	What are the four basic robot configurations available commercially?	BTL-2	Understanding	PO2
28	What is meant by palletizing and depalletizing?	BTL-4	Analyzing	PO2
29	What are the factors to be considered while selecting the robot?	BTL-1	Remembering	PO1
30	What are the disadvantages of robots?	BTL-1	Remembering	PO1,PO3
PART – B & C				
1	Explain any five work envelop of a robot with suitable diagram and mention its applications.	BTL-1	Remembering	PO1,PO2,PO4
2	Describe the important specifications of a robot and choose a suitable robot configuration for transferring 200 gram aluminium rod of 150 mm length. Give your justification.	BTL-5	Evaluating	PO1,PO2,PO3,PO11
3	(i) Sketch a robot wrist and indicate wrist pitch, wrist yaw and wrist roll. (or) Sketch and explain 3 DOF associated with wrist (ii) Explain about major parts of a robot with their functions.	BTL-5	Evaluating	PO1,PO2,PO3,PO12
4	(i) Discuss about the need for Robots (ii) Present a brief survey on how robots are applied in inspection work.	BTL-1	Remembering	PO1,PO2,PO4,PO11
5	Explain any four basic robot configurations with neat sketches and narrate individual merits, demerits and applications.	BTL-5	Evaluating	PO1,PO2,PO4,PO12
6	Write short notes on the following: (i) Types of robot controls (ii) Spatial resolution (iii) Repeatability.	BTL-6	Creating	PO1,PO3,PO11,PO12

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS

Pneumatic Drives - Hydraulic Drives - Mechanical Drives - Electrical Drives - D.C. Servo Motors, Stepper Motors, A.C. Servo Motors - Salient Features, Applications and Comparison of all these Drives, End Effectors – Grippers - Mechanical Grippers, Pneumatic and Hydraulic - Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

PART – A

CO Mapping : C706.2

Q.No	Questions	BT Level	Competence	PO
1	What is an actuator?	BTL-1	Remembering	PO1,PO3
2	What are the factors which must be considered while choosing the drive system for robots?	BTL-1	Remembering	PO1,PO2
3	List the advantages and dis-advantages of hydraulic drive? (or) Which type of drive system is more suitable for heavy load robot application?	BTL-1	Remembering	PO1,PO2
4	List the advantages and disadvantages of pneumatic actuators?	BTL-1	Remembering	PO1,PO2,PO3
5	List the advantages and dis-advantages of Electrical actuator?	BTL-1	Remembering	PO1,PO2
6	Enumerate the difference bet. Open loop and closed loop control system?	BTL-1	Remembering	PO1
7	What are the elements of the closed loop control system ?	BTL-1	Remembering	PO1
8	What is a stepper motor? What are the different types of stepper motor?	BTL-1	Remembering	PO1
9	What are the advantages and disadvantages of Stepper motor?	BTL-1	Remembering	PO1,PO2
10	What are the characteristics of servomotor?	BTL-1	Remembering	PO1,PO2
11	Compare the AC and DC servomotors?	BTL-1	Remembering	PO1,PO2
12	Write about various types of motion convention?	BTL-1	Remembering	PO1
13	Write about the balls screw?	BTL-1	Remembering	PO1
14	Why servomotors are preferred with stepper motor in robot applications?	BTL-2	Understanding	PO1,PO2
15	What are the parts used in harmonic drive?	BTL-1	Remembering	PO1

16	Define End effector. Give some examples of Robot End Effector.	BTL-1	Remembering	PO1,PO2,PO6
17	What is meant by Gripper? What are the types of grippers?	BTL-3	Applying	PO1,PO2,PO3
18	List out the gripper design considerations?	BTL-3	Applying	PO1,PO2
19	What is the difference between internal grippers and external grippers?	BTL-1	Remembering	PO1,PO11,PO12
20	What are the types of Mechanical Grippers?	BTL-1	Remembering	PO1,PO2
21	List any two limitations of magnetic grippers.	BTL-3	Applying	PO1,PO2,PO4
22	What is a stripping device?	BTL-1	Remembering	PO1,PO2
23	List any four important factors to be considered in the selection and design of grippers?	BTL-1	Remembering	PO1,PO2
24	Give some examples of tool as robot End effector.	BTL-1	Remembering	PO1,PO3
25	Name some feedback devices used in robotics.	BTL-1	Remembering	PO1,PO11,PO12
26	What are the types of encoders?	BTL-4	Analyzing	PO1
27	List out the types of Drive systems used in Robots.	BTL-1	Remembering	PO2,PO11
28	Write the characteristics of actuating systems.	BTL-1	Remembering	PO1,PO11
29	List any two unique features of a stepper motor.	BTL-3	Applying	PO1
30	What is a RCC device? for what purpose is it used in a robots?	BTL-1	Remembering	PO1,PO2
PART – B & C				
1	Compare the servo motor with stepper motor choose suitable drive system for industrial robot along with your justification	BTL-3	Applying	PO1,PO2,PO4
2	Classify the end effector. Draw the different mechanism used in the gripper and give application	BTL-5	Evaluating	PO1,PO2,PO4,PO12
3	(i) Discuss various considerations for selection and design of a gripper. (ii) Explain working principle, salient features and applications of A.C. and D.C. Servo motor as robot drive system	BTL-5	Evaluating	PO1,PO2,PO4,PO12
4	State the features of 'Hydraulic and	BTL-5	Evaluating	PO1,PO2,PO3,PO11

	Pneumatic actuators' system with neat sketch.			
5	Explain the various drive system used with an industrial robot with their selection criteria and compare their features, merits and demerits.	BTL-4	Analyzing	PO1,PO2,PO3,PO4
6	(i) Explain vacuum grippers, with reference to the principle and applications. (ii) Explain the robot and end effector interface functions.	BTL-6	Creating	PO1,PO2,PO12,PO6

UNIT III SENSORS AND MACHINE VISION

Requirements of a sensor, Principles and Applications of the following types of sensors – Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors, binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data - Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications - Inspection, Identification, Visual Servicing and Navigation.

PART – A

CO Mapping : C706.3

Q.No	Questions	BT Level	Competence	PO
1	Define vision and vision system?	BTL-1	Remembering	PO1,PO2
2	Classify the vision systems? What are the common imaging devices used for robot vision system?	BTL-1	Remembering	PO1,PO2
3	Define machine vision and its functions?	BTL-1	Remembering	PO1,PO2
4	Write the machine vision stages?	BTL-1	Remembering	PO1,PO2
5	Write the advantages of machine vision system?	BTL-1	Remembering	PO2,PO3
6	What is segmentation? What is thresholding?	BTL-1	Remembering	PO1,PO3
7	Define sensors and transducer.	BTL-3	Applying	PO1,PO2,PO12
8	What are the basic classifications of sensors?	BTL-3	Applying	PO1,PO12
9	Give an application example of a proximity sensor.	BTL-3	Applying	PO1,PO2
10	Brief on the working of inductive type proximity sensor.	BTL-3	Applying	PO1,PO2
11	Name some feedback devices used in robotics.	BTL-3	Applying	PO1,PO2,PO3
12	What is frame grabber? What is a tactile array sensor?	BTL-3	Applying	PO1,PO6
13	Classify the position sensors.	BTL-1	Remembering	PO1,PO2
14	What are the terms that define the performance of the transducers?	BTL-1	Remembering	PO1,PO2,PO3
15	What is LVDT and how does it work?	BTL-1	Remembering	PO1,PO2,PO3
16	Write about hall effect sensors?	BTL-1	Remembering	PO1,PO2,PO12
17	Write about pyroelectric sensor and piezoelectric sensors?	BTL-3	Applying	PO2,PO12
18	What are the types of light sensors?	BTL-3	Applying	PO2,PO3
19	What are photodiodes? What are the uses of	BTL-3	Applying	PO1,PO4

	Sniff sensors?			
20	What are the types and uses of Remote Center Compliance devices (RCC)?	BTL-3	Applying	PO1,PO2,PO4
21	What is an histogram of image?	BTL-3	Applying	PO2,PO4
22	What is meant by windowing and image restoration?	BTL-3	Applying	PO2,PO3,PO4
23	What is region growing, region splitting and edge detection?	BTL-1	Remembering	PO1,PO2
24	What is meant by feature extraction and pattern recognition?	BTL-1	Remembering	PO1,PO2
25	What is meant by quantization and morphology?	BTL-1	Remembering	PO1,PO2
26	Mention any two examples for contact and non-contact sensor.	BTL-2	Understanding	PO2
27	How does charge coupled device differ from charge induction device?	BTL-4	Evaluating	PO1
28	Give an example of touch sensor in the context of a robot.	BTL-2	Understanding	PO1,PO2,PO3
29	What is image analysis? What are the various techniques in image processing and analysis?	BTL-1	Remembering	PO1,PO2,PO3
30	What are areas of application of image processing in the field of robots? Name any two algorithms for image enhancement application.	BTL-1	Remembering	PO1,PO2,PO12
PART – B & C				
1	Explain the working principle of LVDT, Hall Effect sensor and compliance sensor along with respective circuit. Give the limitations of all three sensor mentioned.	BTL-6	Creating	PO1,PO2,PO1 2
2	Write any one algorithm for the edge detection and segmentation of an image. Explain how image segmentation helps to improve the quality of the images in a vision system. Describe the industrial applications of image processing in the field of mechanical engineering.	BTL-6	Creating	PO1,PO3,PO1 2
3	(i) What do you mean by robot vision? Explain. (ii) Explain and compare various lighting techniques used in machine vision.	BTL-6	Creating	PO1,PO3,PO1 2
4	With suitable sketch and citing appropriate application explain the following four sensors. (i) Optical proximity sensors (ii)	BTL-6	Creating	PO1,PO3,PO4

	Binary Touch sensors (iii) Slip sensors.			
5	(i) Describe the four types of photo electric sensors. (ii) Explain in detail the tactile and non-tactile sensors.	BTL-4	Analyzing	PO1,PO2,PO4
6	(i) Consider two frames $\{A\}$ & $\{B\}$. The frame $\{B\}$ is rotated with respect to frame $\{A\}$ by 30 degree. around z-axis and the origin of $\{B\}$ is shifted with respect to the origin of $\{A\}$ by $[5,10,5]$. the Z_a and Z_b axes are parallel point 'p' is described in $\{B\}$ by $(1,2,3)$. Describe the same point with respect to $\{A\}$ using the transform matrix . (ii) Write short note dynamics of a robot.	BLT-6	Creating	PO1,PO2,PO4

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces - Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design - Derivations and problems. Lead through Programming, Robot programming Languages - VAL Programming - Motion Commands, Sensor Commands, End Effector commands and simple Programs.

PART – A

CO Mapping : C706.4

Q.No	Questions	BT Level	Competence	PO
1	What are the methods of robot programming?	BTL-1	Remembering	PO1,PO2,PO12
2	What are the ways of accomplishing lead through programming?	BTL-1	Remembering	PO1,PO2,PO12
3	What is teach pendant?	BTL-3	Applying	PO1,PO2
4	What are the methods of teaching?	BTL-3	Applying	PO1,PO2
5	Write a short note on importance of kinematic study of the robot.	BTL-3	Applying	PO1,PO2
6	What is robot kinematics?	BTL-3	Applying	PO1,PO3
7	What is trajectory planning?	BTL-3	Applying	PO1,PO3,PO4
8	Define degrees of freedom.	BTL-1	Remembering	PO1,PO2
9	Explain joint mode of teaching robots.	BTL-5	Evaluating	PO2,PO3,PO4
10	Explain the reasons for defining points in a program.	BTL-1	Remembering	PO1,PO3,PO4
11	What is position representation?	BTL-1	Remembering	PO2,PO3
12	Define servo controlled robots.	BTL-1	Remembering	PO2,PO3,PO4
13	What is circular Interpolation?	BTL-1	Remembering	PO1,PO2
14	What are irregular smooth motions?	BTL-1	Remembering	PO1,PO2,PO4
15	What is manual lead through programming?	BTL-1	Remembering	PO1,PO2,PO3
16	What is powered lead through programming?	BTL-1	Remembering	PO1,PO2,PO4
17	Write down the limitations of Lead through methods	BTL-1	Remembering	PO1,PO2,PO3
18	Differentiate between Forward kinematics and reverse kinematics?	BTL-2	Understanding	PO1,PO2
19	Explain redundancy.	BTL-1	Remembering	PO1,PO2,PO3
20	Define servo control robots?	BTL-3	Applying	PO1,PO12
21	What are limitations of online and offline robot programming?	BTL-1	Remembering	PO1,PO3
22	List any two applications of straight line	BTL-1	Remembering	PO1,PO11

	interpolation in robotics.			
23	How can you define a manipulator?	BTL-1	Remembering	PO1,PO3
24	Write down the basic types of robot programming.	BTL-1	Remembering	PO1,PO2,PO3,PO12
25	List the Motion control commands used in VAL II programming and describe its functions.	BTL-1	Remembering	PO1,PO2,PO3,PO11,PO12
26	List the Speed control commands used in VAL II programming and describe its functions.	BTL-1	Remembering	PO1,PO2,PO4
27	List the Position control commands used in VAL II programming and describe its functions.	BTL-1	Remembering	PO1,PO2,PO3,PO4
28	List the End effector operation commands used in VAL II programming and describe its functions.	BTL-4	Analyzing	PO1,PO2,PO3,PO4
29	List the Sensor commands used in VAL II programming and describe its functions.	BTL-1	Remembering	PO1,PO2,PO4
30	What are the Robot Programming Languages used?	BTL-1	Remembering	PO1,PO2,PO4
PART – B & C				
1	(i) Explain the four statements of VAL robot programming language. List the commands used in VAL programming and describe its functions. (ii) Write a VAL program for pick-and-place operation on the conveyor system. it consists of two conveyors running parallel with centre distance of 600 mm at same level. An industrial robot is fixed centrally between the conveyors. The robot is used to transfer work pieces from conveyor 1 to 2 at a constant speed. Draw a schematic view of the system .assume all necessary dimension.	BLT-5	Evaluating	PO1,PO4,
2	Draw your environment diagram showing the industrial robot.	BTL-5	Evaluating	PO1,PO2,PO3
3	Illustrate the forward kinematics of a 3 DOF industrial robot with rational joints. Explain the functions of an inverse kinematics algorithm. Draw suitable diagram for your illustration. Mention the advantages of	BLT-5	Evaluating	PO1,PO3,PO4

	forward kinematics over inverse kinematics			
4	(i) Write about sensor and end effector commands. (ii) Differentiate the forward and reverse transformation with an example.	BLT-5	Evaluating	PO1,PO2,PO3,PO4
5	(i) Write an elaborate note on motion commands of robots. (or) Explain Wait, DELAY, SIGNAL commands with suitable examples. (ii) Explain manual lead through programming method in robot application.	BLT-5	Evaluating	PO1,PO3,PO4
6	(i) Explain Denavit-Hartenberg parameters with suitable examples.(ii) Discuss about Programming Languages used in computer controlled robots.	BLT-5	Evaluating	PO1,PO2,PO4,PO6

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS				
RGV, AGV; Implementation of Robots in Industries - Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.				
PART – A				
CO Mapping : C706.5				
Q.No	Questions	BT Level	Competence	PO
1	What are the different types of material handling operation?	BTL-1	Remembering	PO1,PO2,PO4
2	What are the three basic modes of operation in a robot language operating system?	BTL-2	Understanding	PO1,PO2,PO3
3	What is Gantry Robot?	BTL-1	Remembering	PO1,PO2
4	Write some applications of AGV?	BTL-3	Remembering	PO1,PO2,PO3
5	List out types of AGV vehicles?	BTL-3	Remembering	PO1,PO2
6	Distinguish between the AGV and Robot.	BTL-3	Remembering	PO1,PO2
7	Mention the limitations of implementing robots in industry.	BTL-3	Remembering	PO1,PO2,PO3
8	List out any two important factors in the selection of robot for an application.	BTL-3	Remembering	PO1,PO2,PO12
9	List out the few robot applications area in manufacturing.	BTL-1	Remembering	PO1,PO2
10	What are the functions of work cell controller?	BTL-1	Remembering	PO1,PO3
11	State some of the reasons made use of robots in welding operation.	BTL-1	Remembering	PO1,PO4
12	Differentiate palletizing and depalletizing.	BTL-5	Evaluating	PO1,PO12
13	What are the steps to be followed by the company in order to implement robot programs in its operations?	BTL-1	Remembering	PO1,PO2,PO3
14	What are the typical technical features required for material transfer?	BTL-5	Evaluating	PO1,PO2
15	What are the different methods of economic analysis?	BTL-1	Remembering	PO1,PO2,PO3
16	Write a note on ROI method?	BTL-1	Remembering	PO1,PO3
17	Define EUAC method?	BTL-1	Remembering	PO1,PO12
18	Define a dead man switch?	BTL-1	Remembering	PO1,PO12
19	What are the general characteristics that	BTL-1	Remembering	PO1,PO2,PO11

	make potential robot application technically practical and economically feasible?			
20	Define payback period?	BTL-1	Remembering	PO1,PO2
21	What is AGV?	BTL-3	Remembering	PO1,PO2,PO12
22	How does RGV differ from AGV?	BTL-1	Remembering	PO1,PO2,PO3
23	Define MTTR, MTBF?	BTL-1	Remembering	PO1,PO2,PO12
24	What is image resolution?	BTL-1	Remembering	PO1,PO2,PO4
25	Define Tracking?	BTL-1	Remembering	PO1,PO3,PO4
26	Function of robots in a Computer Integrated Manufacturing environment.	BTL-1	Remembering	PO1,PO2,PO3
27	What are the causes of human injury in a robotic environment?	BTL-1	Remembering	PO1,PO2,PO4, PO12
28	List few safety precautions necessary for robotic application.	BTL-1	Remembering	PO1,PO2,PO4, PO12
29	What are the three levels of safety sensor systems in robotics defined by National Bureau of Standards?	BTL-1	Remembering	PO1,PO2,PO4, PO12
30	What are the benefits of industrial robots?	BTL-4	Analyzing	PO1,PO2,PO3
PART – B & C				
1	Discuss the various steps to be taken for implementing robots in industry and safety issues. Write the advantages of using robots in industry.	BLT-5	Evaluating	PO1,PO2,PO3 ,PO12
2	Illustrate the pay back and rate of return method of economic analysis while implementing robots in industry suitable example problem.	BLT-5	Evaluating	PO1,PO2,PO3
3	(i) Briefly explain AGV & RGV types of robots in detail. (ii) Briefly explain the various steps involved for implementing the robot in industries.	BLT-5	Evaluating	PO1,PO2,PO12
4	Briefly explain the economic analysis of Robots in detail.	BLT-5	Evaluating	PO1,PO3,PO6
5	Briefly explain the Safety sensors and safety monitoring of Robots in detail.	BLT-5	Evaluating	PO1,PO2,PO4
6	List and explain direct and indirect costs involved in a robot application project. Justify whether you gain profit or loss.	BLT-5	Evaluating	PO1,PO2,PO4