MODEL ANSWER

WINTER– 18 EXAMINATION

Subject Title: Estimation and Costing Subject Code: 17557

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

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Q. No.	MODEL ANSWER	Marks
1	**Attempt any five of the following**	**5 X 4= 20**
a)	**Definition** Costing has been defined by Institute of Cost and Works Accountants, England as: " The technique and process of ascertaining costs" It is the determination of an actual cost of an article, after adding different expenses incurred in various departments. **Objectives:** a. To determine cost of article b. To determine cost of incurred during each operation c. To provide information to ascertain selling price of product d. To supply info for detection of wastage e. It helps in reducing total cost of manufacturing f. It suggests, changes in design, when cost is higher g. To help formulating the policies h. To provide info for economic consideration for purchasing new machines i. To help management in decision making j. To facilitate preparation of estimate for tender **k.** To compare actual cost with estimated cost.	**02 Marks** **02 Marks**
b)	Different Modes of material wastage are: **1) By Nature** (a) Avoidable (b) Unavoidable **2) By Resources** (a) Man-hours (b) Materials (c) Machine-hours (d) Production facilities **3) By their cause** (a) Poorplanning and design wastage (b) Transportation wastage (c) Wastage due to defective purchasing practices (d) Storage wastage **4) By outputs** (a) Reusable wastage	**02 Marks for any 02 modes**

	(b) Usable wastage **Control over material cost:** Material cost is a main component in the total cost of the product (varying from 25 to 65%). Therefore in order to control the cost, it is necessary to pay maximum attention for controlling material cost in following ways. 1) Control over abnormal losses 2) Material handling 3) Control over Inventory 4) Reclamation from defective products 5) Control over consumption 6) Protection of stores 7) Procurement of material a) Purchase at right time b) Right source c) Right quality d) Right Quantity e) Right Contract f) Right Palce of delivery	**02 Marks for any 04 ways**
c)	**Functions of an estimator:** i. To prepare estimate on the request from sales department or from production department or from "Cost estimating and Cost Accounting" department ii. To consult production department, purchase departmentand other connected departments, like Time study department, and plannng department for collecting latest informations related to various aspects necessary for preparation of correct estimates. iii. To consult the reference files of his own section for finding cost of materials needed, time for production and overheads, etc. iv. To collect the informations, related to engineering design and specification of the product, manufacturing methods or procedures, tools and equipment required, and material handling. v. To collect informations and use them for preparation of estimates related to tool, equipment and pattern cost, transportation costs, profits etc. **Qualitites of estimator:** i. He must be able to read and understand drawings and blue prints well.	**02 marks for any 02 Functions** **02 marks for any 02 Qualities**

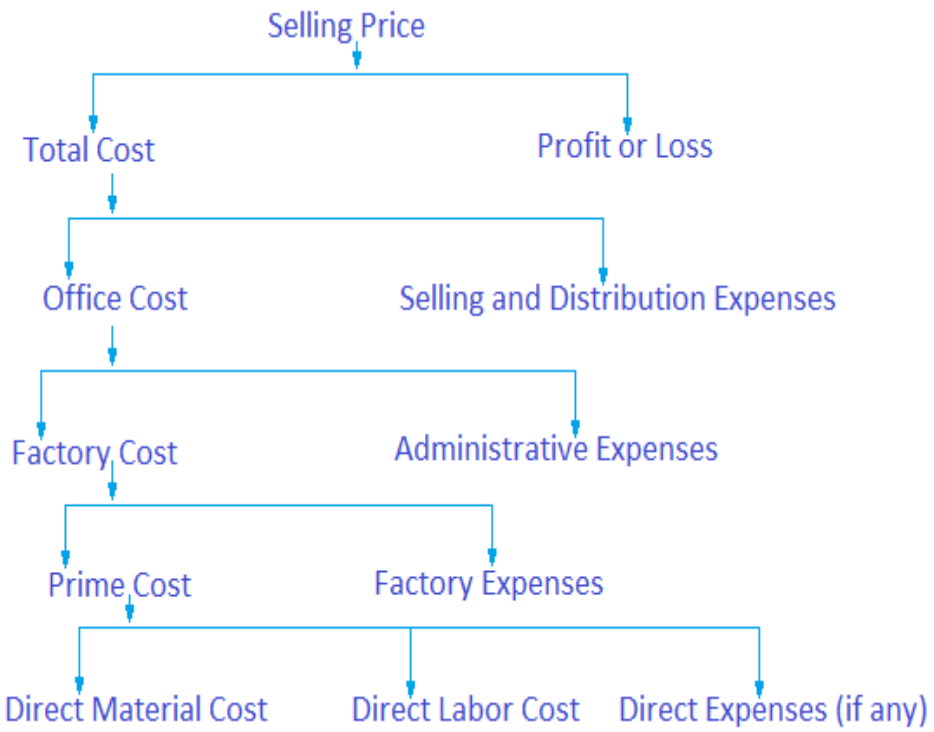
ii. He must have good knowledge of different machines, their operations
iii. He should have good knowledge for use of proper tools, jigs and fixtures.
iv. He must have good knowledge of market prices
v. He must have good knowledge about the wage rates.
vi. Should have knowledge about different allowances.
vii. Should have good knowledge about cutting speeds, feeds and depths of cuts for different materials.
viii. Must be well qualified and trained technical person. Able to suggest new methods.
ix. He must know official account classification.
x. Must know the procedure of "time and motion study"
xi. Should also have knowledge about business matters.
xii. Must co-operate with other departments.

d)

No	Costing	Estimating
1)	Costing is the determination of actual cost of the product by adding various elements of expenses incurred	Estimation is aimed to calculate the probable cost of product before the manufacturing starts
2)	Costing requires the knowledge of accounts and therefore costing is done by accountants	Estimation requires a highly technical knowledge, hence an estimator is basically an engineer
3)	Costing tells after the manufacture about profitability of the product	Estimation forecasts about the probable cost and hence one can know before the manufacture that manufacturing of product shall be profitable or not, whether one should manufacture it or not
4)	It determines cost of each article included in the product	It predetermines the cost of whole product
5)	It supplies information for detection of wastages	It cannot supply information for detection of wastages.

04 Marks for any 04 points

e)	i) To find out the cost of the direct material used for installation or erection purpose. This also involves in-direct expenditure on material handling equipment such as ropes, chains, splices, jigs etc. ii) To find out the labour involved in certain erection work this laborers are mostly on temporary basis and will be paid on daily or weekly wages. iii) To find out overheads which cannot be categorized in any particular area this involves cost of repair & maintenance, insurance for various people and machines. It also includes electricity charges and water utility tax.	**04 Marks**
f)	Various losses in forging are as follows. i) Tong loss: while forging, some length of stock is required for holding the job in tong. This length is an extra length and is known as tong loss. ii) Scale loss: the outer surface of the hot metal is generally oxidized and when hammering is done oxidized film is broken and falls down in form of scale. Hence it is called scale loss iii) Flash loss: It is the surplus material which comes out between the two meeting surface of dies. For getting finished product this has to be trimmed off. iv) Shear loss: in sawing operation, some material is always lost. This loss is taken to be 5% of net wt. v) Sprue loss: The portion of metal between the length held in tong and the material in die is called sprue. This is also a metal loss.	**04 Marks for Any 04 Losses**

g)	Cost Flow chart in Process costing  	**04 Marks**
2.	Attempt any Two of the following	**2 X 8= 16**
a)	**Given data,** Number of Products = 1000 (in one batch) Direct Material Cost = ₹2,50,000 Direct Labour Cost = ₹4,00,000 Direct Expenses = ₹1,80,000 Factory Expenses = 60% of Labour Cost Administrative Expenses = 120% of Labour Cost Selling and Distribution Expenses= ₹60,000 Profit= 10% of Total Cost **To Find:** i) PrimeCost ii) Factory Cost iii) Manufacturing Cost (Office Cost) iv) Total Cost v) Selling price per product	

	Calculation:	
	i) Factory Expenses = 60% of Labour Cost = (60/100) x Labour Cost = 0.6 X 4.00,000 = **₹2,40,000**	**½ Mark**
	ii) Administartive Expenses = 120% of Labour Cost = (120/100) X Labour Cost = 1.2 x 4,00,000 = **₹4,80,000**	**½ Mark**
	iii) Prime Cost = Direct Manufacturing Cost + Direct Labour Cost + Direct Expenses = 2,50,000+ 4,00,000+ 1,80,000 = **₹ 8,30,000**	**01 Mark**
	iv) Factory Cost = Prime Cost + Factory Expenses = 8,30,000+ 2,40,000 = **₹ 10,70,000**	**01 Mark**
	v) Manufacturing Cost (Office Cost) = Factory Cost + Administrtive Exp. = 10,70,000 + 4,80,000 = **₹ 15,50,000**	**01 Mark**
	vi) Total Cost = Manufacturing Cost + Selling & Distribution Expenses = 15,50,000 + 60,000 = **₹ 16,10,000**	**01 Mark**
	vii) Profit = 10% of Total Cost (Given) = (10/100) X Total Cost = 0.1 X 16,10,000 = **₹1,61,000**	**01 Mark**
	viii) Selling Price of Batch of 1000 = Total Cost + Profit = 16,10,000 + 1,61,000	**01 Mark**

	Products = **₹ 17,71,000** ix) Selling Price per Product = S.P. of 1000 Products / Number of Products = 17,71,000 / 1000 = **₹ 1,771**	**01 Mark**
b	**Fixed Price Method:** In this method, issued material is charged at a predetermined estimated price, for a fixed period. Mostly for one year one rate is charged. Therefore, receipts and issues are recorded in quantities only which make store keeping easy. This method is also known as "Standard Price" method. Price is generally fixed on the basis of past experience and future trends. **Current Value Method:** This method charges current market price for the materials irrespective of the purchased price. This helps in estimating the actual cost of product by which tenders can stand market competition. This system involves a great difficulty in finding out actual market price at every issue from the stores and therefore not so common.	**04 Marks** **04 Marks**
c	**Different Wage Plans** a) Nominal Wages b) Real Wages c) Living Wages d) Fair wages e) Minimum Wages **Time Rate System**: Under this system, the worker is paid by the hour, day, week, or month. • High Wage plan: Under this plan a worker is paid a wage rate which is substantially higher than the rate prevailing in the area or in the industry. In return, he is expected to maintain a very high level of performance, both quantitative and qualitative. • Measured day work : According to this method the hourly rate of the time worker consists of two parts, namely, fixed and variable. The fixed element is based on the nature of the job i.e. the rate for this part is fixed on the basis of job requirements. The variable	**01 Mark** **02 Marks**

	portion varies for each worker depending upon his merit rating and the cost-of-living index. • Differential time rate : According to this method, different hourly rates are fixed for different levels of efficiency. **Piece Rate System** • Straight piece work system : The wages of the worker depend upon his output and rate of each unit of output; it is in fact independent of the time taken by him. • Differential piece work system: This system provide for higher rewards to more efficient workers. For different levels of output below and above the standard, different piece rates are applicable. • Taylor Differential Piece Work System • Merrick Differential Piece-rate System •	**02 Marks**
	Various forms of Incentives a) Financial Incentives b) Non-Financial Incentives It is something that encourages a worker to put in more productive efforts voluntarily. Mostly, workers are not willing to exert themselves to produce anywhere near their full capacity unless their interest in work iscreated by some kind of reward, This is called Incentive.	**01 mark**
	Effect of incentives on productivity and performance of the plant a) Apart from the direct reduction in Labour cost, there is indirect saving due to reduction of shop and machine charges as the time is saved. b) Workers are encouraged to increase production to earn more c) Workers day wages are guaranteed, even if they are not able to complete the job in standard time. In case the job is completed in less than the specified time, incentive is earned d) This promotes relations between employers and employees The success of the incentive system depends on efficient and sufficient machines and tools, avoidance of delay and interruptions. If the rate of incentive is too high, it will result in loss to employees and if it is too low it will fail to induce workers.	**02 Marks**

3.	Attempt any two of the following	**2 X 8 = 16**
a	**Depreciation:** Efficiency and value of machine or asset reduces with the lapse of time during use this is called depreciation. Generally money is kept aside known as 'sinking fund' **Obsolescence:** Reduction in the value of existing machinery or asset due to new and better invention or design of equipment or process etc. **Following are the major causes of depreciation** i) Depreciation due to wear and tear. Everybody knows that when any machinery performs work, wear and tear of certain components takes place. Cost incurred due to this is value of depreciation due to wear and tear ii) Depreciation due to physical decay. There are certain items in a factory, such as, insulation of material, furniture, electric cables, poles, buildings, chemicals and vessels etc., which get decay because of climatic condition. This reduction in value is depreciation due to physical decay. iii) Accidental depreciation. Accident may occur due to some wrong operation or some loose component or some other cause, which result in heavy damage. The depreciation due to this is accidental depreciation. iv) Depreciation due to deferred maintenance and neglect. If proper maintenance is not done as recommended by manufacturer, then the value of the machine or vehicle may be reduced and depreciation value because of this is called depreciation due to deferred maintenance and neglect. v) Inadequacy. Inadequacy means reduction in efficiency of an asset. This may result in the production. Also if the demand of the product increases there is a need for bigger or another machine of similar size. This cost is called depreciation due to inadequacy. vi) Depreciation by obsolescence. If new machinery comes in market, better and cheaper than existing one, hence the existing machinery has to be replaced to withstand market competition. This is called as depreciation by obsolescence.	**01 Mark** **01 Mark** **06 Marks for Any 03 causes**

b	Given Data: C = ₹ 40,00,000/- S = ₹ 4,00,000/- N = 10 Years Sum of the Years = 10+9+8+7+6+5+4+3+2+1 = **55** C-S = (40,00,000-4,00,000) = **₹36,00,000** Depreciation at the end of 5 Year = (6/55) X (C-S) = (6/55) x (40,00,000-4,00,000) = **₹ 3,92,727.27**	**02 Marks** **02 Marks** **04 Marks**
c	**Estimating Procedure related to fabrication shop** i) Production planning department decides the requirements and specifications of the product ii) Production planning department makes out the drawings, lays down the method sequence of operations, machines to be used, rates allowed to the labour in consultation with the time and motion studyDepartment and wages department iii) To decide accuracy and finish required iv) To prepare a list of the components of the product v) To decide which component canbe manufactured in concern itself and which should be procured from outside vi) Determine the material cost by calculating the qualities of various types of material required **Tool Cost:** The expenses incurred from the time when the tool touches the job till the end of operation on including its maintenance and purchase cost is called tool cost. **Elements of Tool Cost:** i) Engineering and Design cost: The engineering and design cost of the tool, often as high as 20 to 30 percent. This cost can be directly charged to the individual tool and as a consequence arealways considered first in establishing an estimate ii) Tool material cost: The cost of the material for a proposedvtool may be calculated	**04 Marks for any 04 points** **04 Marks for any 02 points**

	and therefore become smore of an actual cost than an estimated cost. It is the most acurate item in the tool-cost estimate iii) Tool Labour Cost: The labour involved in the machining, assembling, fitting, and tryout of tools. iv) Burden or Overhead: The toolroom may be considered as a department, and therefore may have an established burden rate.	
4.	Attempt any two of the following	**2 X 8 =16**
a	Given Data: Round bar diameter = 35mm =3.5 cm Round bar Length = 300mm=30 cm Side of hexagonal Section = 16mm (forged by hand forging) Scale loss = 6% To find: Length of the forged Hexagonal bar (L)=? i) Volume of round bar = $\pi r^2 l$ = $\pi(1.75)^2$ X 30 = **288.633 cm^3** ii) Scale Loss = 6% of volume = 0.06 X 288.633 = **17.318 cm^3** iii) Consider Scale Loss So Total Volume = Volume of Round Bar + Scale Loss = 288.633 + 17.318 = **305.950 cm^3** iv) Total volume = Volume of hexagonal bar 305.950 = ((3√3)/2) X $Side^2$ X L 305.950 = 6.651 X L Therefore, L = (305.950/6.651) **L = 46.00 cm**	**02 Marks** **02 Marks** **02 Marks** **02 Marks**

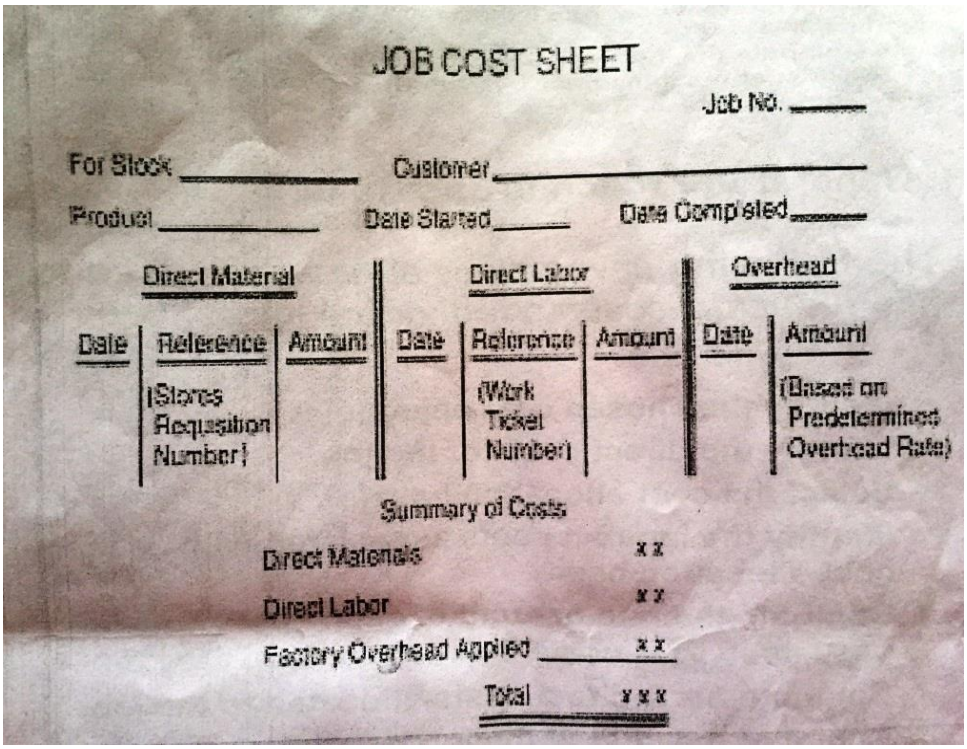
b	The parameters on which turning time will depend are - Cutting Speed (S) in m/minute - Number Of Revolution (N) in revolutions per minute - Initial Diameter of the Shaft to be turned (D) in cm - Feed rate of tool i.e. feed / revolution (F) in cm/rev, mm/rev - Length to be turned in cm, mm For turning, the given initial diameter in question 25mm =2.5cm will considered for calculation Expression for turning time calculation $R.P.M. = \frac{100S}{\pi D}$ $D = Dia\ of\ shaft\ to\ be\ turned$ $total\ time = \frac{length\ to\ be\ turned}{N\ X\ feed/\ rev}\quad in\ minutes$	**03 Marks** **05 Marks**
c	Given data: Number of Holes = 6 D= 15mm = 1.5cm Depth of hole = 25mm = 2.5cm S =20.4m/min F = 0.15mm/revolution =0.015cm/rev Time (T) =? i) N = (100S/πD) = (100 X 20.4/ π X 1.5) = **<u>432.90 r.p.m.</u>** ii) Time for drilling one hole T = Depth of hole / (F X N) T = 2.5 / (0.015 X 432.90) T = **<u>0.385 min</u>** iii) Time to drill 6 holes = 6 X T = 6 X 0.385 = **<u>2.31 min or 138.6 seconds</u>**	**03 Marks** **03 Marks** **02 Marks**

5.	Attempt any two of the following	**2 X 8= 16**
a	There are certain factors which affect largely on the welding cost. These factors are as follows. i) Time required for handling and setting the job and equipment in correct position ii) Time required for fixing fixtures. iii) Rest and fatigue time allowance. iv) Excessive welding. v) When excessive current is used, welding cost also increases.	**04 Marks**
	Estimation of Gas cutting cost: Gas cutting cost may be estimated by considering following elements: (i) Actual Cutting cost: This Includes (a) cost of material used in cutting process, like cost of oxygen, acetylene, etc. (b) Labour Cost (ii) Finishing Cost: This is the expenditure made on finishing and cleaning in cut parts (iii) On-Costs: These are the other overhead charges made on equipment and other items which are connected with cutting processes	**04 Marks**
b	Numerical: Volume of head $\frac{\pi}{6}h^2(3D-2h)$ h= 18mm= 1.8cm D=2*24=48mm = 4.8cm, D_s (Shank Dia)= 28mm =2.8cm L = 54mm = 5.4cm $\therefore Volume = \frac{\pi}{6} \times 3.24(3 \times 4.8 - 2 \times 1.8)$ $\underline{= \mathbf{18.32\ cm^3}}$ Volume of Cylinder $= \frac{\pi}{4} Ds^2 L$ $\underline{= \mathbf{33.25 cm^3}}$	**02 Marks**
	Total Volume = 18.32+33.25 = $\underline{\mathbf{51.57\ cm^3}}$	**02 Marks**

	Weight of one rivet $= \frac{51.57 \times 8}{1000}$ $\underline{= \mathbf{0.412\ kg}}$ No. of rivets which can be manufactured from 5kg M.S = 5/0.412 = 12.11 ~ **12 rivets**	**02 Marks** **02 Marks**
c	Capacity of Power press: For capacity calculation purposes power presses can be divided into two categories : (*i*) the shaft of which is driven (by gearing or by belt) from one end ; (*ii*) the shaft of which is driven from both the ends. For calculation of capacity of these presses following empirical relations are generally used : (*i*) When shaft is driven from both end : Maximum pressure available, in tonnes = $0.5\ D^2$ where, D is the crank pin dia in cm, (*ii*) When shaft is driven from one ends : Maximum pressure available, in tonnes = $0.75\ D^2$ As, Shearing force required = Area to be sheared × Shearing stress. Hence, while procuring power press its crank pin dia must be decided and can be calculated by knowing the maximum shearing force required and using the above relations and putting the proper shearing stres of the material required to be used. Therefore, shearing stress for some of the important metals given hereunder : Aluminium = 0.72 tonne/cm^2 Mild Steel = 3.1 tonnes/cm^2 Alloy Steel = 5.7 tonnes/cm^2 Tin = 0.3 tonnes/cm^2 It is generally expressed in terms of Tonnage of a Press as shown from an eg. below; To determine the tonnage capacity for cutting a rectangular blank of size a *b cm^2 from MS plate of thickness, t cm by using a press having D cm diameter pin, we have; Pressure required to cut the rectangular blanks = Area to be sheared * Shearing stress	**08 Marks**

	of MS = 2(a + b) * t * Shearing stress of MS = X tonnes	
6.	Attempt any Two of the following:	**2 X 8 =16**
a	**Procedure of sheet metal shop estimation involves:** i) Estimation of time Before proceeding to actual operation, strip is to be picked up.entered in the the dies andprocedss is started,these preparation itemsa generally require 15sec for small stripes to 30sec for heavy strips.This preparation time of 15 to 30sec os equally divided among the balnks in each strip. Actual operations, are generally performed on presees, either having automatic feeding arrangement or manual feedmg. In automatic feeding all he strokes of the ram are utilised for blanking.While in hand feeding nearly 40% of the strokes are generally missed. After blanking operation is. over 10 to 15 sec per strip are required for collecting the blanks and disposing the bridges, 10 to 15% calculated as above, generally added, for fatigue and personal needs etc.to get esttmated time. ii) Estimating for inserting, piercing, ejecting, etc. After the blanks are prepared each of the balnks is to be inserted in the press to get the desired shape. For inserting (also known as loading) a blank, estimated time is generally taken as: 2 to 5 sec for small components. 6 to 8 sec for medium components(of size say between 25 cm X 25 cm to 50cm x 50cm) 8 to 10 sec for large size components. To pierce a hole in acomponent generally 2 sec are taken.Ejection or removal of the component after operation is over generally takes 10sec. If it is done manually and 2sec if it is done on automatic machine. **Blank Layout:** For preparing an article, layout is required to be done on the sheet metal first. For this purpose an outline of the object is drawn or scratched on the sheet metal directly. Sheet is cut in accordance with layout and then different other operations are performed on it to give required shape of the article. At the time of layout allowances must be kept for different operations like, raising, wiring, jointing, hemming etc.	**04 Marks** **02 Marks**

	Importance of Blank Layout and their effects are: i) Provides an outline of the object either on the sheet metal directly or firstly on paper which is then transferred to the sheet ii) Enables the ease of cutting in accordance to the outline prepared iii) Enables other operations like forming, assembling etc. to give required shape of the article iv) Helps to decide allowances to be provided for operations like raising, wiring, jointing, hemming, etc. v) For lot production, helps to decide width of strip to be cut vi) With help of patterns (templates), helps to evaluate an economical layout. vii) Helps, achieve economy in material use viii) Helps, achieve economy in labor employed	**02 Marks for any 02 points**
b	**Forging operation:** The shape of material can be transformed by forging with the aid of the following operations: **1. Drawing Down**. It is also known as Drawing Out. This operation is performed to increase the length of the workpiece in forging by decreasing the cross-sectional area.This process is performed by hammering the hot workpiece lengthwise to reduce cross-section. **2. Up Setting**. This is the reverse of Drawing Down operation.In this operation, the cross-section of the workpiece is increased at the expense oflength. This process is performed by hammering one end of hot workpiece while other end is supported against the anvil. **3. Bending.** Bending is done by holding the workpiece between two fixtures and desired bend can be given by striking the workpiece with the help'of hammer, This operation can also be carried out on the anvil beak. **4. Punching and Drafting**. Punching operation is perfcrmed by a tool called punch, for producing holes in the workpiece, when it is in the hot state ; and drafting is an operation carried on by a special tool known as draft to enlarge the hole.	**04 Marks**
	Hand Forging and Machine Forging: **Hand forging:** When the forging is done by hand,the process is known as hand forging. In case of heavy jobs, smith is assisted by a hammer-man. Important hand forging operations are drawing, upsetting, bending, punching, swaging and shearing etc. **Machine forging:** the process in which forging is done by machines are known as machine forging. Machine forging is useful for heavy and complicated job requiring large forces.	**04 Marks**

c	**Job Cost Sheet:**  JOB COST SHEET Job No. _____ For Stock _____ Customer _____ Product _____ Date Started _____ Date Completed _____ Direct Material: Date	Reference (Stores Requisition Number)	Amount Direct Labor: Date	Reference (Work Ticket Number)	Amount Overhead: Date	Amount (Based on Predetermined Overhead Rate) Summary of Costs Direct Materials x x Direct Labor x x Factory Overhead Applied x x Total x x x **Following are the characteristics of process cost accounting** i. The output consists of product which are homogenous ii. Production is carried on in different stages having continuous flow iii. Production takes place continuously except in cases where the plant and machinery are shut down for maintenance etc. iv. The input will pass through two or more processes before it takes shape of the output. v. The output of the process may also be saleable in which case the process may generate some profit. vi. The input of process may be capable of being acquired from outside sources. vii. The output of a process is transferred to next process generally at the cost of process. Normal and abnormal losses may arise in the process	**04 Marks** **04 Marks**