SUMMER – 13 EXAMINATION

Subject Code: **12154** **Model Answer**

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 judgement 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.

Q. 1)a) Attempt any three.

a) How non - traditional machining processes are classified? Give importance of non - traditional machining processes.

Ans: Non - traditional machining processes are classified according to the major energy sources employed in machining.

i.e Thermal energy methods, Mechanical, Electro – chemical, Chemical (2 marks)

(a) Thermal energy methods

i) Electric discharge machining(EDM)
ii) Wire cut EDM (WEDM)
iii) Laser beam machining (LBM)
iv) Ion beam machining (IBM)
v) Electron beam machining (EBM)
vi) Elecric discharge grinding (EDG)
vii) Plasma arc Machining (PAM)

(b) Mechanical

(i) Abrasive Jet machining (AJM)

(ii) Ultrasonic machining (USM)

(iii) Water Jet machining(WJM)

(c) Electro – chemical

(i) Electro – chemical machining (ECM)

(ii) Electro – chemical Grinding(ECG)

(d) Chemical

(i) Chemical machining (CHM)

Importance of non - traditional machining processes (2 Marks)

- Any material can be machined irrespective of its hardness.
- Any complicated shapes can be produced on the workpiece.
- To machine composite.
- To avoid damage to the surface.
- To machine deep hole with small diameter.

Q1(a)(b) (Each points one mark) (4 marks)

	Subroutine	**Canned Cycle**
1.	It is the separate program which is called in the main program.	It is not a program but part of the main program.
2.	It is used when multiple passes are required at different locations.	It is used when multiple passes are required at the same locations.
3.	It is called & ended by miscellaneous function.	It is called & ended by preparatory function.
4.	One point is given in every block of instruction till the operation is completed.	Directly the final point is given in the block of instruction.
5.	The cutter path for every point is to be given by the programmer.	The cutter path for every pass is generated by the controller.

Q.(1a) (c) What are the types of automation? (4)

Types of automation

(i) Fixed automation

(ii) Programmable automation

(iii) Flexible automation

(iv) Integrated automation

Fixed automation (1)

- Machines arranged in sequence of operation.
- Inflexible, not for variety of product
- For large scale production , production rates are high
- Product design is constant for long period of time.
- Initial cost is high
- e.g. Transfer lines, automated assembly lines

Programmable automation (1)

- sequence of operation depends on programme
- New programme for new product
- Flexibility in variation and changes in product configuration
- Use for low volume production, parts are produce in batches
- High investment
- e.g. NC machine tool , PLC , industrial robots

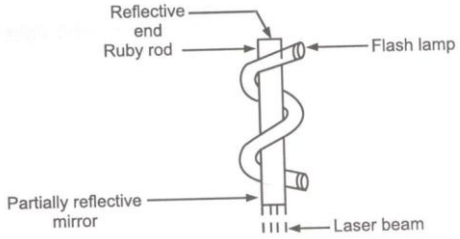
Flexible automation (1)

- Capable of producing variety of parts
- Product's design changes possible
- High initial investment
- Continuous type of production
- e.g. FMS

Integrated automation (1)

- Integrated to the computer network
- Includes PPC, Shop floor control, quality control, purchasing & marketing
- Product design changes are possible to reduce cost
- e.g. CIM

Q(1a) (d) Explain laser action in ruby rod.

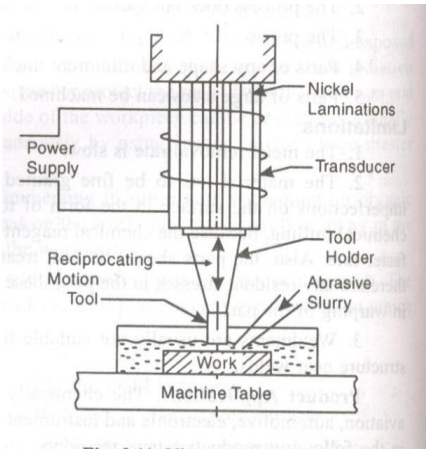


(fig.1mark, Exp. 3 marks)

- Commonly use solid state laser in ruby rod.
- Ruby rod laser material is in the form of crystal of aluminum oxide or sapphire that contains about 0.05% chromium
- Fabricated into rods about 150mm long and their ends are finished to close optical tolerances.
- The Xenon lamp is fired by discharging a large capacitor through it (Electric power of 250 to 1000 Watts)
- Ends of ruby rod are mode reflective by mirrors
- Two mirrors parallel to each other are provided at each end to reflect the incoming light
- One of these mirrors is fully reflective while the other is partially reflective allow the light to pass through it
- When light is thrown by the flash lamp on the ruby rod, the chromium atoms inside it get excited to higher energy level
- The ruby rod works with maximum effect when kept at a very low temp. for this liquid nitrogen at -196^0 c is employed
- Flash lamp operates best when it is warm. Hence hot air is circulating around it

Q(1b) (a) Describe the set-up of USM with neat sketch

The ultrasonic process is a copying process in which the shape of the work produced depends upon the shape of tool. The accuracy of the work also depends upon the accuracy of the tool used.



(fig.2 mark dist. 4 marks)

Important Elements of USM

i) Machining Unit:- As supplied as cutting heads for mounting on general purpose machine tools and their shapes are similar to milling machines.

ii) Generator and Transducer :- Generator consists of power output system, stable frequency with possibility of being regulated over a wide range, compact, reliable and easy to operate system.

Transducer vibrates at the frequency of the applied voltage and helps in vibrating the tool at high frequency.

iii) Tool Holder :- Holds the tool tightly and transfers the vibrations.

iv) Abrasive Slurry :- Boron carbide, Aluminium oxide and silicon carbide used as abrasive slurry. The grain size of an abrasive has a marked effect on the material removal rate and surface finish.

v) Tool Shape and Tool Material :- Generally tough and ductile tool material is used in USM. Low carbon steels and stainless steels are commonly used.The tool size is equal to the hole size minus twice the size of the abrasive, and its shape is similar to the component to be machined.

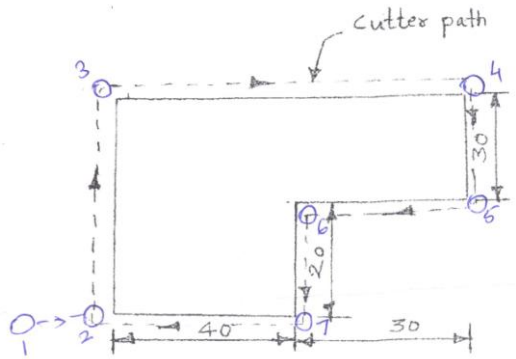
Metal Removal Rate :- Wear Ratio is Volume of material removed from work/Volume of material eroded from tool. Mathematically MRR in USM is a very complex process that depends on many variables.

Q(1b) (b) What are the common requirements of tool material for EDM and name the common tool materials?

(each point 1 marks)

I. Good conductor of electricity
II. High thermal conductivity
III. Cheap and readily available
IV. Low wear rate
V. Low electric resistance
VI. Good Machinability
VII. High melting point

Q.(2) (a) CNC Programme



Position No.	X & Y Co-	Position No.	X & Y Co-

	ordinates		ordinates
1	(-10,-10)	5	(73,17)
2	(-3,-3)	6	(43,17)
3	(-3,-53)	7	(43,-3)
4	(73,53)		

(Table & fig. 2 marks, Prog. 6 marks)

10223

N100 G28 U00 W00 EOB

N110 G90 G21 G94 EOB

N120 M06 T01 EOB

N130 M03 S800 EOB

N140 G00 X-10 Y-10 EOB

N150 G00 Z5 M08 EOB

N160 G01 Z-3 F90 EOB

N170 X-3 Y-3 EOB

N180 Y53 EOB

N190 X73 EOB

N200 Y17 EOB

N210 X43 EOB

N220 Y-3 EOB

N230 G00 Z5 EOB

N240 G28 U00 V00 W00 EOB

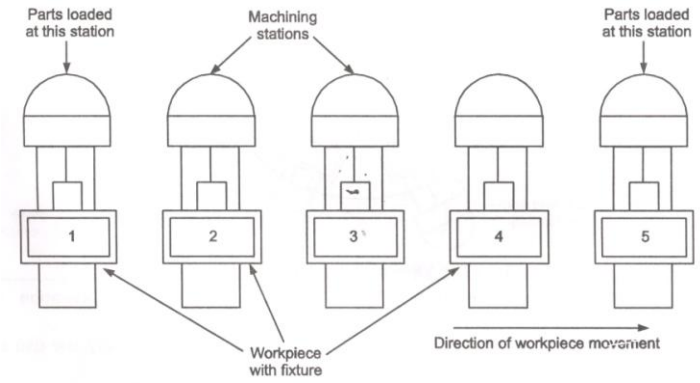
N250 M05 EOB

N260 M09 EOB

N270 M30 EOB

(b) What is an in-line transfer machine? Explain with a neat sketch.

- The machine tools are arrange in straight line as shown in fig.



(Sketch. 2 marks, Expl. 6 marks)

- For less floor space area various geometric arrangements like L, C, or U type square or rectangular used for machine arrangement
- Workpiece is loaded clamped, operated, unclamped and unloaded along with the fixture at each station.
- Two methods are used to transfer the workpiece from one machine station to another (a. Pallet type ; b. Plain type)

  Pallet type – In this type of transfer machine the workpiece is clamped in a holding fixture called as pallet and transferred from station to station throughout the entire operation. An endless chain conveyor is used for this purpose. After the operations are completed pallet is returned by conveyor to the loading station.

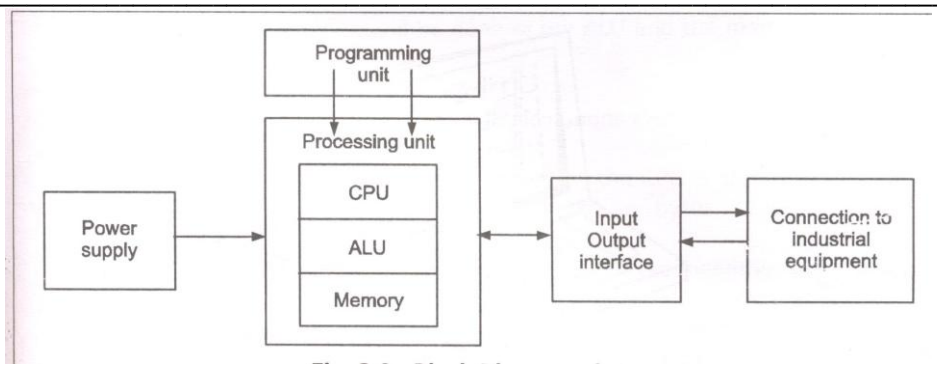
  Plain type – In this type of transfer machine the workpiece is moved in an unclamped position from station to station throughout the entire operation. In this the fixtures are fixed and only the workpieces are moved. This type is used for light workpieces having regular shape.

(c) Explain programmable logic controller with a block diagram.

The programmable controllers are also called as programmable logic controllers because its operation requires many logic functions to be performed.

The basic elements or components of a PLC are :

I. Power supply unit
II. Programming unit
III. Processor
IV. Input Output section
V. Housing (fig. 2 marks , dist. 6 marks)



Power supply unit – The power supply unit provides voltage that is necessary to operate the circuit throughout the controller. Some sections of the PLC such as input and output unit require an AC voltage. Other sections like internal circuit of processing unit require a low level DC voltage.

Programming unit – The programming unit is an external electronic device that is connected to the PLC when programming occurs. It allows the user to enter data and to edit and monitor programs stored in the processor unit. It unit communicates with the processor unit by using a data communication link. The first is the CRT terminal. The second type of unit is a small key board with this data is entered

Processor - The processor is a computer that executes a program to perform the specific operations. It controls the operation of the entire system. The processor is composed of three main units.

Central Processing Unit (CPU)

Arithmetic Logic Unit (ALU)

Memory

CPU: It is the brain of the PLC. The main function of the CPU is to interpret & execute computer base programs that are permanently stored in the processors memory.

ALU: Performs mathematical calculations & make logic calculations.

Memory: The program & other data required by the CPU is stored in the memory unit. The memory can be RAM or ROM.

Input Output section – The input interface is designed to receive process and machine signals and convert them into an acceptable form for the PLC. The output interface converts PLC control signals into a form which can be used by the process equipment. Inputs are defined as the signals given to the controller. Outputs are defined as signals given from the controller to the industrial equipment.

Housing – The elements of PLC are installed in a suitable housing to withstand the shop environment.

Que 3 :- Attempt any Four **(Fig** 1+2+1)

a) Ans :- The term ultrasonic refers to waves of high frequency, generally above the hearing range of a normal human ear, i.e. generally above 20 kHz. In this process, a cutting tool oscillates at high frequency in abrasive slurry. The tool has the same shape as the shape to be machined. The impact of the abrasive is mainly responsible for metal removal. This method is generally used to machine hard and brittle materials.

The removal of material takes place due to the action of every abrasive grain, which is hammered into the work surface by a high-frequency oscillating tool. The most appropriate frequencies in this case are 20,000-30,000 cps with amplitude of 0.2 mm. The electronics oscillator and amplifier, also known as generator, convert the electrical energy at low frequency to high frequency. The transducer works on the principle magnetostriction. The magnetostriction effect is one in which the material changes in dimension in response to an electric field. The vibrations thus produced are focused on the cutting point by means of a horn or a tuned vibration concentrator. The abrasive used in the process is supplied in the form of slurry suspended in a carrier fluid and the tool feed is achieved by means of static loading of the vibrator head that transmits vibrations to the tool.

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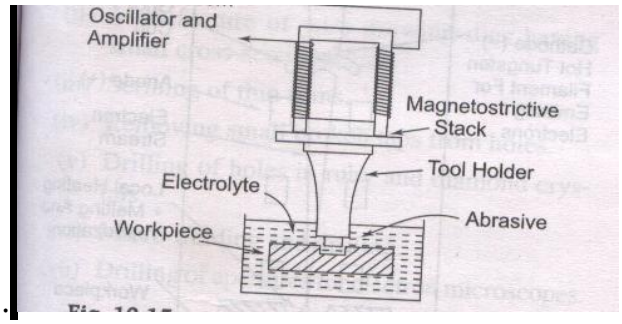

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vi) Metal Removal Rate :- Wear Ratio is Volume of material removed from work/Volume of material eroded from tool.Mathematically MRR in USM is a very complex process that depends on many variables.

Applications of USM

i) Machining of holes of any shape
ii) Coining of glass and ceramics
iii) Threading by properly rotating the workpiece
iv) Tool and die making
v) Dentistry, Jewellery for shaping of precious stones.

b) Ans : (1 mark for each point)

EDM	LBM
1.The removal of material takes place by repetitive,short-lived electric sparks between the tool and the workpiece	1.The removal of material takes place by means of an intense monochromatic beam of light called laser which is an electromagnetic radiation
2.High MRR	2.Low MRR
3.Tool wear	3.No tool wear
4.Suitable for complicated components	4.Extremely small holes are machined not suitable for complicated components
5.It cannot be applied to non conducting materials	5.It is applied on non conducting materials
6.Moderately low cost	6. High cost
7.Heat affected zone is high	7.Hear affected zone is small
8. Examples like press tools, forging dies, thread cutting, helical profile and curved hole drilling.	8. Examples like welding, micromachining, sheet metal trimming, blanking and engraving.

c) Ans:- **ATC** (Explanation-3Mark,Types:1 Mark)

An ATC consists of a tool magazine for storing of tools change unit for transferring the tool from tool magazine to spindle.The tool already fitted on the spindle is removed and replaced in the tool magazine. Tool change cycle consists of two parts tool selection cycle and tool transfer cycle. A machining center type machine tool is a four-axis, horizontal spindle machining center with a carousel-type automatic tool changer and which is adapted to be controlled by a computer numerical control system. The machining center can

perform a variety of machining operations, such as milling, contouring, drilling, tapping and boring, in both roughing and finishing applications. A rotary work table is operatively carried on two movable, perpendicularly disposed slide members to provide movement of the work table along both "X" and "Z" axes. A horizontal tool spindle slide assembly is slide mounted on a "Y" axis on a twin column assembly. A rotary, carousel-type combination tool storage and tool changer, holding twenty-four tools, is rotary table mounted on a horizontal axis that is aligned and parallel with the axis of the horizontal tool spindle. The rotary carousel functions to automatically load and unload tools directly into the tool spindle at a tool exchange location. The tool spindle extracts the tools from the carousel, and inserts the tools back into the carousel after a cutting operation. The machining center includes a manually operated optional pallet changer for automatically loading a pallet carrying a new work piece onto the work table, and unloading the pallet with a finished work piece from the work table. The tool spindle is provided with automatic mechanical spindle positioning for each spindle stop.

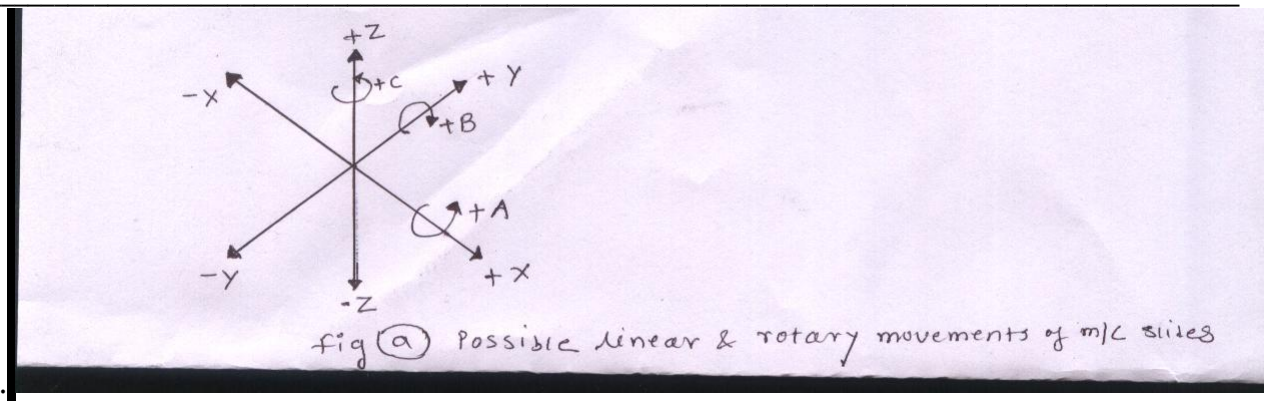
Types of ATC

1. Drum type :- Tools are stored on the periphery of drum and suitable for holding tools upto 30.
2. Chain type :- This is suitable for more tools 30 to 40 or more.
3. NC egg box tool magazine :- The cutting tools are stored in the magazine in a rectangular pattern. To select a tool the program is complied to position the spindle opposite and coaxial with the required tool. The spindle moves forward and engages with shank of the tool and the shank is gripped by a drawbar or collect. The spindle is retracted to remove the tool from the magazine and the slides are actuated to move the tool to its machining position.

D) Ans:- **(Fig-2 mark Explanation-2Mark)**

Most of the machines have two or more slideways, disposed at right angles to each other,along which the slides are displaced.Each slide can be fitted with a control system and for the purpose of giving commands to the control system the axis have to be identified.The basis of axis identification is the 3-dimensional Cartesian co-ordinate system and the three axis of movement are identified as X,Y and Z axis.The possible linear and rotary movements of machine slides/workpiece are shown in fig a.Rotary movements about X,Y and Z axix are designated as A,B and C respectively.

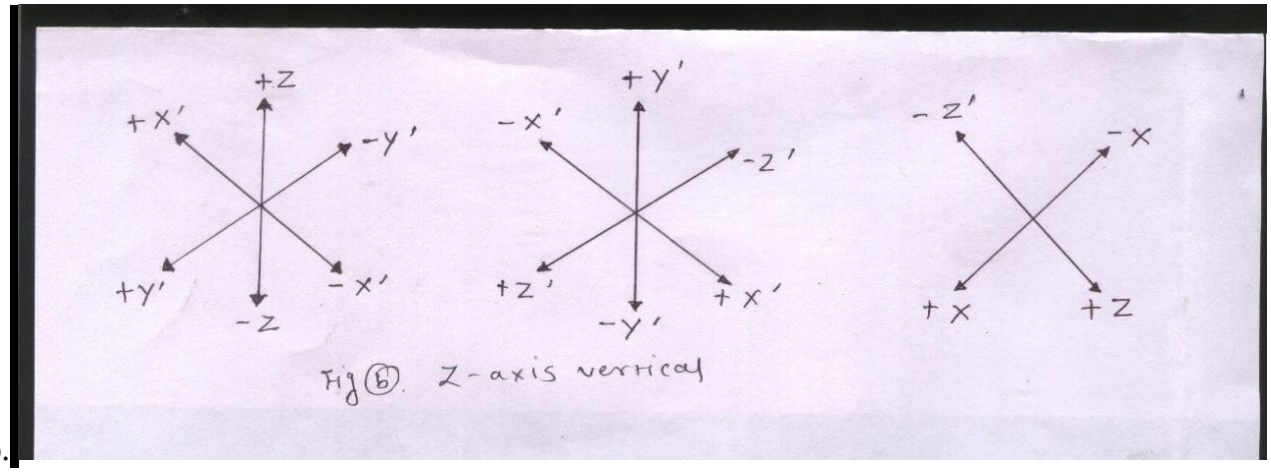
Fig a.



The main axis of movement and the direction of movement along these axis is identified as follows:

Z-axis: The Z-axis of motion is always the axis of the main spindle of the machine.It does not matter whether the spindles carries the workpiece or the cutting tool.If there are several spindles on a machine,one spindle is selected as a principle spindle and its axis is then considered to be Z-axis.On vertical machining centres,the Z-axis is vertical and on horizontal machining centres and turning centres,the Z-axis is horizontal.Positive Z movement (+Z) is in the direction that increases the distance between the workpiece and thetool.Convention of designating the Z-axix on milling,drilling and turning machines is shown in fig b.

Fig b.



X-axis : The X-axis is always horizontal and is always parallel to thework holding surface.If the Z-axis is vertical,as in vertical milling machine,positive X-axis (+X) movement is identified as being to the right,when looking from the spindle towards its supporting column.

If Z-axis is also horizontal as in turning centres,positive X-axis motion is to the right,when looking from the spindle towards the workpiece.

Y-axis : The Y-axis is always at right angles to both the X-axis and Z-axis.Positive Y-axis movement (+Y) is always such as to complete the standard 3-dimentional co-ordinate system.

Rotary axis : The rotary motion about the X,Y and Z-axis are identified by A,B,C respectively.Clockwise rotation is designated positive movement and counter-clockwise rotation as negative movement.Positive rotation is identified looking in +X,+Y and +Z directions respectively.

e) Ans :- **(Any four -4 Mark)**

Wire Electric Discharge Machining (WEDM) is one of the important non-traditional machining processes for machining of intricate profiles in conductive and difficult to machine materials. The machining performance of this process largely depends on various process parameters, such as wire drive system, power supply system, dielectric system, positioning system applied voltage, ignition pulse current, pulse-off time, pulse duration, serve controlled reference mean voltage, servo-speed variation and injection pressure. As WEDM is a complex process, it is difficult to determine optimal parameters for improving cutting performance, which is cutting velocity and surface finish. It is important to note that it is not possible to have a unique set of optimal combination of cutting parameters as the influence of the above cutting parameters on both the responses are opposite to each other.

Wire Drive System:

It serves two purposes i.e. continuously delivers fresh wire and always keeps the wire under appropriate tension so that it moves in the machining zone as a straight wire. Wire is a thin single-strand metal wire, usually brass, is fed through the workpiece, submerged in a tank of dielectric fluid, typically deionized water. Wire-cut EDM is typically used to cut plates as thick as 300mm and to make punches, tools, and dies from hard metals that are difficult to machine with other methods.

The wire, which is constantly fed from a spool, is held between upper and lower diamond guides. The guides, usually CNC-controlled, move in the *x–y* plane. On most machines, the upper guide can also move independently in the *z–u–v* axis, giving rise to the ability to cut tapered and transitioning shapes The upper guide can control axis movements in *x–y–u–v–i–j–k–l–*. This allows the wire-cut EDM to be programmed to cut very intricate and delicate shapes.

Dielectric System:

Water is likely substitute for kerosene as dielectric .It is an attractive proposition because of its availability, desirable thermal properties, low viscosity and pollution free working. It gives high Material Removal Rate and better surface finish under the machining condition.

The wire-cut process uses water as its dielectric fluid, controlling its resistivity and other electrical properties with filters and de-ionizer units. The water flushes the cut debris away from the cutting zone. Flushing is an important factor in determining the maximum feed rate for a given material thickness.

Power Supply System:

Basically in pulse frequency which is about 1Mhz.It results in reduced crater size or better surface finish.However because of very small wire size it usually cannot carry current more than 20A.

Positioning System :

It is CNC two axes table operates in an adaptive control mode.So that in case wire approaches very near to the workpiece or the gap is bridged by debris and causes a short circuit.The positioning system should be capable to sense it. Instantaneously it should move back to reestablish proper cutting conditions in the gap.

Que 4: Attempt any Three

a) Ans :- (Each Point 1 Mark)

1.Machine tool maintenance is to achieve minimum breakdown and to keep them in good working condition at the lowest possible cost.

2..Machine tools are properly maintained so that they remain in working condition at all the times, their accuracy does not deteriorate and manufacture the components most economically.

3.Machine tools should be kept in such a condition which permits them to be used at their optimum capacity without any interruption.

4.Machine tool maintenance ensures the availability of the machines and services required by other sections of the factory for the performance of their functions at optimum return on investment whether this investment be in material, machinery or personnel.

5. Machine tool maintenance inspected the machine tools periodically against use of wrong or inadequate lubrication, change in level of the machine tools, wrong use and overloading of the machine tools, wear of slideways, bearings and other components, vibration and chatter.

Types of Maintenance

a) Corrective Maintenance
b) Predictive Maintenance
c) Breakdown Maintenance
d) Scheduled Maintenance
e) Preventive Maintenance

b) Principle of SPM: (Explanation -4Mark)

SPM is specially designed for specific operations or jobs.These are basically multiway, multispindle machines and many tools work on the same workpiece from different directions, thus no. of operations are performed on the job simultaneously which is possible to produce the jobs efficiently with high rate of production. Operation performed in two ways 1.Those in which the job fixed in one position i.e automatic feeding M/c, turret and capstan lathe and 2. Those in which job moves from one station to other i.e transfer machine

c) Maintenance Manual

If you have a maintenance manual, using it to make repairs or do maintenance on machine can be much simpler and efficient. Most manuals are self explanatory, but here are some tips on getting more out of yours.

i) Make sure you are reading the right manual.
ii) Look for specific sections detailing the type of service or repair you are going to perform. E.g. lubrication, inspection etc.
iii) Read the table of contents to search for the topics that you are looking for.
iv) Look in the index for key words or phrases related to the specific task you intend to perform.
v) Read the section that describes the task you are undertaking.
vi) Look in the abbreviation.
vii) Look for specific warning.
viii) Follow the instructions to carry out the maintenance carefully.

d) Ans:- Advantages of preventive maintenance over breakdown maintenance (½ Each)

1) Reduced breakdown and connected down-time

2) Lesser odd time repairs and reduced overtime to the maintenance work force

3)Greater safety for the workers

4) Less stand by or reserve equipment, and spare parts

5) Better product quality and fewer product rejects

6)Low Maintenance and repair costs,lower unit cost of manufacture and increased equipment life.

7) Better industrial relations because production workers do not face involuntary lay-offs or loss of incentive bonus because of breakdowns.

8)Identification of equipments requiring high maintenance costs.

Que 4 b) Attempt any One (6 Mark)

a) Stages of Repair Cycle:- Inspection,small repair,medium repair and complete overhaul

- Preventive maintenance involves carrying out inspection, repair and complete overhaul of the machine.
- The inspection and repair activities are carried out on the machine tool in a particular sequence.
- This sequence is determined forehand in the early life of the machine.
- Thus the cycle of I, R (small or medium repair) and C (complete overhaul) is repeated till three or four overhauling.
- The cycle of inspection, small repair and medium repair between two complete overhauls is called as repair cycle.
- **OR** The cycle from machine commissioning to first complete overhaul is called as repair cycle.
- For example,
  (i) $I_1 - S_1 - I_2 - S_2 - I_3 - M_1 - I_4 - S_3 - I_5 - S_4 - I_6 - M_2 - I_7 - S_5 - I_8 - S_6 - I_9 - C$ is a repair cycle for a particular grinding machine. After every inspections, small repair is carried out. However, after every three inspections, medium repair is carried out and after two medium repairs, complete overhauling is carried out.
  (ii) $C - I_1 - I_2 - I_3 - S_1 - I_4 - I_5 - I_6 - M_1 - I_7 - I_8 - I_9 - S_2 - I_{10} - I_{11} - I_{12} - C$ is a repair cycle for an elevator which consists of one medium repair, two small repairs and twelve inspections between two overhauls.

b) (6 points 6 Mark)

Turret lathe	Capstan lathe
1.Turret head is mounted directly on the saddle	1. Head is mounted on an auxiliary slide which moves on the guide ways provided on the saddle.
2.For feeding the tools to the work the entire saddle unit is moved	2. In this saddle is fixed at a convenient distance from the work and the tools are fed by moving the slide.
3. It suits to heavy chucking work, in addition to the bar work on large size bars upto 200 mm dia.	3.It suits for bar work only and that for relatively smaller sized bars, say upto 60 mm.
4. The tool feeding is relatively slower and provides more fatigue to the operator's hands.	4. The tool traverse is faster and offers less fatigue to the hands of the operator.
5.A turret lathe may carry either a reach-over type or side hang type carriage.	5. A capstan lathe is usually equipped with a reach over because it is used for relatively smaller job.
6.Heaveier designs of turret lathes are usually provided with pneumatic or hydraulic chucks to ensure a firmer grip over heavy jobs.	6. There is no such requirement in case of a capstan lathe

Q.5 Attempts' any 4 of the following . Each carries one mark

a) What are the output char. O f EDM process? (4)

Ans - Following are the main 4 characteristics of EDM – Each one carries one mark.

i) Metal Removal Rate : (MRR) 1/01 of the metal removed from the work per unit time depends on density of current and it increases with increase in current

- MRR is approximately 80mm^3/sec
- High MRR produces poor surface finish. (1)

ii) Surface finish : Surface finish of the work piece depends on the MRR

- Surface finish can improved increasing the spark frequency.
- For rough cuts high current and for finish cut less current is used. (1)

iii) Accurancy : Tolerance of the order ± 0.05 to 0.13 mm are easily obtained and by close controls of current and other variables, tolerances of ± 0.003 to 0.013mm are also possible. And overcut of 100μm is produced. (1)

iv) Tool wear : In EDM process there is always some tool wear. This tool wear is decreased by increase in pulse duration. It also depends on MRR, around of current and spark gap (1)

b) Explain the need of cutter radius compensation. Need of the cutter radius compensation. (3+1)

Ans - When a multipoint toll i.e. end mill or slot mills are used to machine the work piece, cutting takes place by the periphery of cutting tool and not by centre of cutter. A part program has to be developed for the exact size of the cutter to be used on the machine.

But during actual machining if a smaller diameter cutter is selected. It will resulted in larger work piece and similarly larger diameter cutter will result in smaller work piece. It is therefore to compensate for the different diameter cutter by using cutter radias compensation. Compensation is done by off setting the tool path by the distance equal to the radius of cutter. For any change in the cutter diameter, theis off set can be changed. There is no need to make any change in the part program. This value of the raids is entered into the memory of control system under the address D01 or D02. When the off set is called the tool path will automatically by offset by the tool radius. The cutter compensation can be made to the right or to the left of the part to be machined

G40 – Cutter compensation cancel

G41 – Compensation left G42 – Compensation right.

c) What are the causes of failure of coupling? How they are eliminated. (3+1)

Ans - Following are the failure factors. I) Excessive torque loading due to improper coupling selection.

ii) Improper installation

iii) Possibly due to improper hub size selection.

iv) Excessive for signal vibration . Excessive vibration can loosen bolts.

v) Hardened rubber due to chemical contamination

vi)Lack of maintenance.

vii) Improper coupling alignment

viii) Sludge contamination reduces coupling flexibility, leading fatiglee failure.

ix) Improper lubrication

They are eliminated by adopting following maintenance can –

i) Required regular schedule inspection.

ii) Visual inspection of each element.

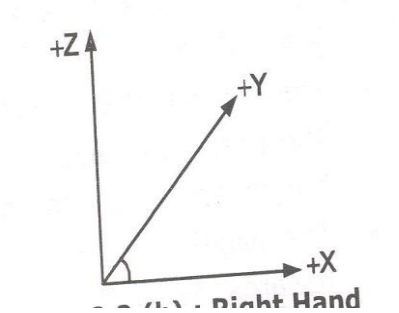
iii) Proper lubrication.

iv) Documenting the maintenance performed on each coupling.

d) Explain axis identification on CNC (4)

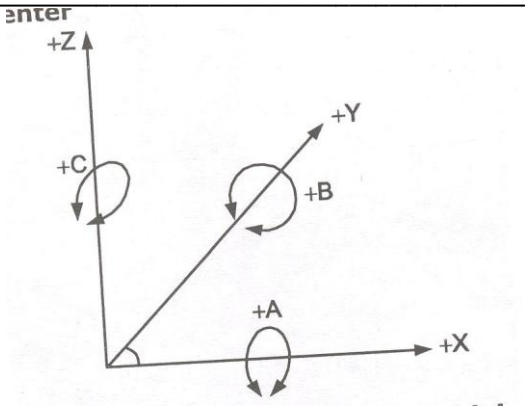
Ans - The axes on the machining centers are divided into two types

i) Linear axes - X,Y,Z axes are known as linear axes as shown in fig.



ii) Rotary axes – A,B ,and C are rotary axes as shown in fig.

(1)



Z – axis – is fixed to the machine tool along the main spin on vertical matching centres Z axis is vertical and horizontal machining center Z axis is horizontal. The positive Z axis is taken in the direction that causes the cutting tool to move from the work piece it mean that movement of the cutter in upward direction is +ve Z axis. The movement of the tool in down ward direction towards the work piece is set as – ve Z axis. (1)

X – axis - It is always horizontal and parallel to the of work table. When looking from the tool spindle to the column the positive x direction is to the right. (1)

Y – axis – It is perpendicular to both X and Z axis . It is also horizontal and indicates the cross travel of the table. (1)

A Axis - It is the axis of rotary motion of a tool along x axis, clockwise rotation is considered as +ve and is identified by look in + X direction.

B Axis - It s the axis of rotary motion of a tool along Y axis. Clockwise rotation is considered a positive movement and is identified by looking in + Y direction.

C Axis - It is the axis of rotary motion of tool a long.

Z Axis - clockwise direction is considered as positive movement and is identified by looking in +Z direction.

e) Transfer Machining : It consist of several individual machine tool arranged in a sequence and connected together by means of suitable material handling equipment or units. Each machine in this series is called a station and performs operation repeatedly on every work piece. Work pieces are loaded at the first machining center. All the stations operate simultaneously on the different work piece and the work piece are automatically transferred to the next station along with its fixture. The number of work piece being machined at one time is equal to number of workstations. As the numbers of machining head are arranged in sequence. They are called as transfer machines. In every cycle of the transfer machine one complete part is produced. For example: Automobile assembly air craft industry. (3)

Types of transfer machining:

i) In-line transfer machining - Pallet type

ii) Rotary transfer machining – Plain type

iii) Drum type transfer machine (1)

f) Explain need and characteristics of machining centers : (2+2)

Need – i) To reduce the non-productive ting

ii) To increase the productivity

iii) To reduce the floor space area significantly.

iv) To reduce no of skilled operators and hence their problem associated with them.

v) reduced no of fixtures because no of machining heads work on same work piece.

Characteristics of machining center

i) These are versatile machines capable of changeover from one type of product to another.

ii) The time required for loading and unloading the work piece, changing tools is reduced which mining's the machining cost.

iii) They are capable of handling efficiently the parts of various shapes and sizes.

iv) They can repetitively produce a high dimensional accuracy.

v) Faster cutting speeds and heavier cutting depths and feed can be achieved.

Q.6 Attempts any four of the following .

a) State and explain types of lasers.

There are three types of lasers –

i)Gas lasers ii)Crystal lasers (Solid laser) iii) Semiconductor lasers (1)

i) Gas lasers – are generally (1)

a) Helium – neon laser is common because of its low cost

b) Carbon dioxide laser are often used in industry for cutting and welding.

c) Metal ion lasers that generate deep ultra violate wavelengths.

d) Other is Argon-ion, Helium silver neon-copper

ii) Solid laser: In which the atoms that emit light are fixed within a crystal or glossy material.

For example – a) Ruby rod – the chromium atoms embedded in the ruby aluminum oxide (1)

b) Yttrium lithium fluoride (Nd : YLF) used for cutting welding and also used in spectroscopy.

iii) Semiconductor lasers: Quantum cascade lasers have an active transition between energy sub-band an electron in a structure attaining several quantum wells. (1)

b) Tool presetting: To most machine tool users, the meaning of presetting tool is actually closer to measuring of tool length. The tool is mounted in the tool holder with tool length approximately correct. The gauge length of the tool is then measured in a presetting station or by a touch off procedure in the machine tool. The difference between the actual tool length used when the NC program was prepared is entered in the CNC as a tool length offset. The control used the offset to adjust the CNC program correctly position the tool tip.

The importance of presetting i) It reduces machine down time

ii) Decrease tool inventory

iii) Lower scrap rate

iv) Increase part quality

c) List factors on which TPM system is based.

i) It is operator oriented maintenance with the involvement of all qualified employees in all maintenance activities.

ii) Based on zero maintenance and zero defects

iii) Maintenance plus continuing efforts to adapt, modify and refine equipment to increase flexibility reduce material handling and promotes continuous flows.

iv) Involving machine operators in preliminary maintenance activities by encouraging them

v) Encouraging operators to report indications maintenance department.

vi) Establishing a maintenance education and training program. (2)

Benefits to organization by TPM

i) Overall equipment effectiveness and overall efficiency are maximized.

ii) It take the guess work out of determining which machine needs major repairs or rebuilding.

iii)The operator carries out only needed corrective actions maintenance is done.

iv) Operators improve their job skills.

v) Operators are motivated by improvement in maintaining their own machines and by involvement in team

based concepts. (2)

vi) Operator involvement in the process gives them ownership of making the project success.

vii) A preventive maintenance program for lifecycle of the equipment is development

viii) Capacity are maximized

ix) Costs are minimized

x) Product quality is improved

xi) Improved safety

xii) The manufacturing process is continuously improved

d) Differentiate between limit switches and proximity switches any 4 points (4)

Limit switches	Proximity switches
1)These require physical contact between target object and switch activator 2)They are comparatively slow in operation as they require physical contact 3) It is an electrical device 4) A limit switch changes state when an object reaches the end of its ranges 5) Since these devices contain mechanical parts they wear over a period of time. 6) Limit switches. They are used in conveyor systems transfer machines automatic turret lathes cranes and hoists.	1)Allow the user to detect the presence of material without having to make physical contact. 2) They are fast in operation as no physical contact is required. 3) It is either magnetic or infrared device 4) A proximity switch changes state when some object gets within a specified distance of the switch. 5) Since it has no moving parts. It is good for dirty or wet locations, It has no mechanical failures. 6) Proximity switches. They are used in lifts tops petrochemical machines photo copiers washing machines food processing packaging machines.

e) Describe the tool holder and work holding devices in CNC .

Tool holders used on CNC machine tool should be quick changing type and should be capable of being preset. Since in the modern CNC machines, there is a provision for automatic tool changing the quick changing type tool holders can reduce the tool change time to about 3 to 5 seconds.

Work holding devices: The CNC are capable of performing a number of operations using different tools on different faces of a component in a single setting. This requires that the component should be accessible from different sides without changing of clamps or repositioning of components. The work holding device has to bear multidirectional cutting forces. To reduce the clamping / unclamping time hydraulic and pneumatic actuation is widely used in work holding devices.

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