



MODEL ANSWER

SUMMER– 17 EXAMINATION

Subject Title:Advanced Industrial Electronics

Subject Code: **17542**

Important Instructions to examiners:

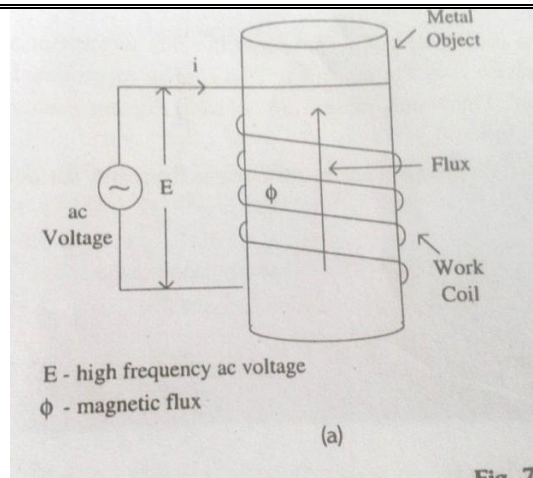
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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 anyequivalent 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. No.	Sub Q.N.	Answer	Marking Scheme
Q.1		Attempt any THREE :	12-Total Marks
	(i)	List the advantages of modern industry.	4M
	Ans:	i) Better working conditions are available. ii) Production rate is increased. iii) Overall production cost is reduced. iv) Quality and reliability of product is higher. v) Component procedure is uniform. vi) Human fatigue is reduced. vii) Automatic control process.	1M Any Four Points
	(ii)	What is NDT? List the methods of NDT.	4M
	Ans:	<p><u>NDT:</u> Nondestructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used.</p> <p style="text-align: center;"><u>OR</u></p> <p>NDT detects flaws and non-homogeneities in the material without destroying or disturbing the properties of material i.e. size, shape, chemical composition, gradual structure etc.</p> <p><u>Methods of NDT:</u> 1. Visual inspection</p>	2M
			2M Any

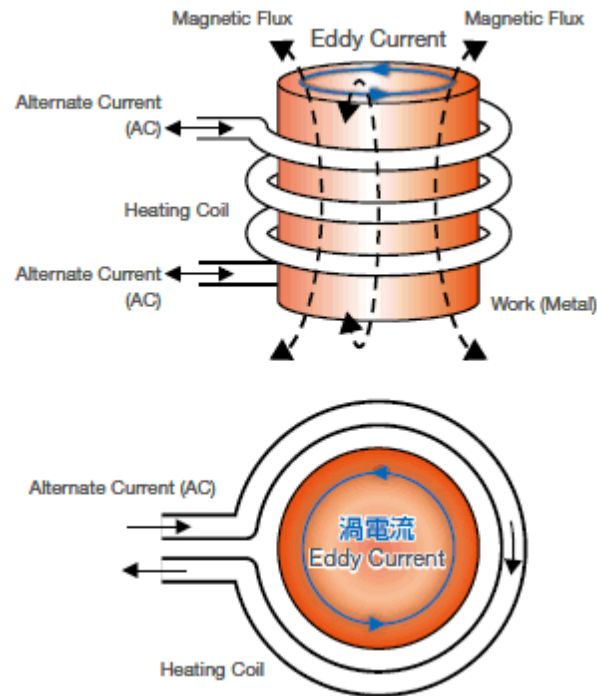
	<ol style="list-style-type: none"> 2. Ultrasonic Testing 3. Magnetic Particle Testing 4. Radiography 5. Liquid Penetrate 6. Eddy current Testing 7. Thermal testing 8. Acoustic emission testing 	Four Types
(iii)	Explain the principle of magnetic crack detection.	4M
Ans:	<p><u>Diagram:</u></p> <p><u>Explanation:</u></p> <ul style="list-style-type: none"> • Magnetic particle Inspection (MPI) is a non-destructive testing (NDT) process for detecting surface and slightly subsurface discontinuities in ferromagnetic material such as iron, nickel, cobalt, and some of their alloys. The process puts a magnetic field into the part. The piece can be magnetized by direct or indirect magnetization. Direct magnetization occurs when the electric current is passed through the test object and a magnetic field is formed in the material. Indirect magnetization occurs when no electric current is passed through the test object, but a magnetic field is applied from an outside source. <p><u>Principle of magnetic crack detection:</u> when a ferromagnetic material is magnetized any magnetic discontinuities that lie in the direction approximately perpendicular to the applied field direction will result in the formation of leakage field. This resulted leakage field is present on the surface of the material which is detected visibly by use of magnetic particles</p>	2M
(iv)	What is high frequency heating? List different types of high frequency heating.	4M
Ans:	<p><u>High frequency heating:</u> There are different methods of heating</p>	2M



	<p>Electrical heating method is the most convenient in operation and also clean. Electrical heating is also have high efficiency, accuracy. Fast response, automatic control higher range of heating etc. Electric heating in which high frequency source is use is called as High Frequency Heating The high frequency heating methods operates in the frequency range between 5-500KHz</p> <p><u>Types of high frequency heating Techniques:</u> Induction Heating Dielectric Heating Microwave Heating Infrared Heating</p>	2M
(B)	Attempt any ONE :	6M
(i)	Explain different input media used in NC machines.	6M
Ans:	<p><u>Different media used to input the information for NC machine :</u></p> <ul style="list-style-type: none">• Input medium is the program of instructions, detailed step by step of directions which tell the machine tool what to do and in what sequence.• The part program is written in the coded form and contains all the information needed for machining the components• The part program is fed to the machine control unit through some medium or storage devices like punched cards, punch tape, magnetic tape, floppy disk, etc. <p>i. Punch card is the most primitive input medium for NC machine. Nowadays, it is not widely used. Eg IBM punch card.</p> <p>ii. Punch tape is made up of material like plastic or paper having dimensions of about one inch wide. It includes 8 tracks and can store character digit or any special character. The information is punched on the tape in the standard code like EIA or ISO</p> <p>iii. Magnetic tape and disks are widely used in NC machine as they have large storage capacity. The data is stored in the coded form. The width of tape is 6mm or 25 mm magnetic disk on the floppy disk are circular in nature and made up of magnetic oxide.</p>	1M 2M 1M 1M 1M
(ii)	Explain principle of induction heating. With appropriate diagram. List the applications of induction heating.	6M
Ans	<u>Diagram :</u>	2M



OR



Explanation:

1. The metal object to be heated is wound by a coil, which is called as work coil through which alternating current is passed by applying ac voltage.
2. Here the work coil acts as primary winding and the metal object acts as short circuited secondary winding.
3. Due to alternating current flowing through the coil, AC magnetic field is produced in the metal object

2M



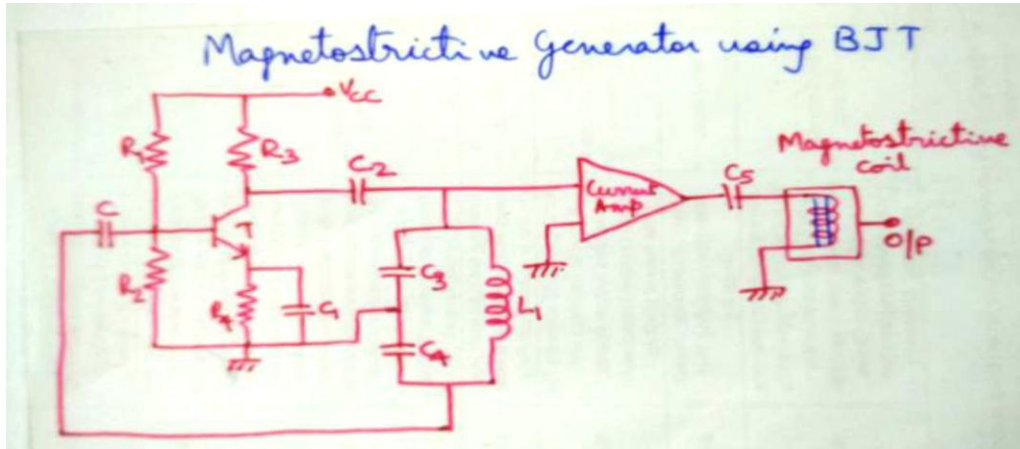
	<p>4. Due to induced voltage ac eddy currents flow through the metal object, results in power dissipation at the secondary winding. 5. Thus eddy currents are produced through inductance and the heating method is called as induction heating.</p> <p style="text-align: center;"><u>OR</u></p> <p>When a metal object to be heated is wound by a coil, which is called as work coil through which alternating current is passed, AC magnetic field is produced in the metal object The emf induced by magnetic flux 'e' is given by $e = -d\Phi / dt$ Due to induced voltage 'e' AC eddy current flows through metal object in circular path at right angle to the flux. This eddy current results in power dissipation in the resistance, thus generating maximum heat at the surface</p> <p><u>Applications of Induction Heating:</u> Surface hardening of steel Annealing Soldering Brazing</p>	<p>2M Any Two points</p>
Q 2	Attempt any FOUR :	16M
(a)	What is industrial safety? Give safety procedures.	
Ans:	<p><u>Industrial safety:</u> Industrial safety in the context of occupational safety and health refers to the management of all operations and events within an industry, for protecting its employees and assets by minimizing hazards, risks, accidents and near misses. The relevant laws, compliance and best practices in the industry have most of the issues addressed for the best protection possible. Employers are to make sure that these are strictly adhered to to have maximum safety.</p> <p><u>Safety Procedures:</u> 1. Please read and understand the instructions before using any instrument, machine or plant. 2. Only specialized personnel well trained about electricity and its effects must use it. 3. Do not take measurements in an explosive atmosphere ie. gas, fuels or dust. 4. Preventing shortcuts 5. House-keeping should be proper 6. Should never ignore safety procedures 7. Do not touch exposed metal parts or circuits 8. Prevent any accident contact of yourself or others with the measuring voltage. 9. Safety symbols should be used and followed. 10. One should be very careful while driving vehicle.</p>	<p>2M Any Four Points (½ m Each)</p>

(b) Explain the principle of magnetostrictive effect of ultrasonic wave generation and draw the transistorized oscillator circuit for the same.

4M

Ans: Diagram:

2M



Principle of magnetostrictive effect

All the ferromagnetic materials exhibit mechanical deformations when subjected to magnetic field.

This phenomenon is known as magnetostriction.

This effect is independent of direction of the magnetic field.

Explanation:

- 1) The transistor is used as a basic oscillator. The oscillator circuit may be Colpitts type or Hartley type.
- 2) The above circuit shows Colpitts oscillator. The transistor T works as an oscillator with the tank circuit components as C3, C4 and L1. These components also help to determine the frequency of ultrasonic wave.
- 3) The oscillations generated by transistor are applied to current amplifier where level of signal is increased so that it drives magneto-strictive coil.
- 4) These oscillations are coupled to the coil with the help of capacitor. Due to magneto-strictive effect, ultrasonic vibrations are generated at the output.

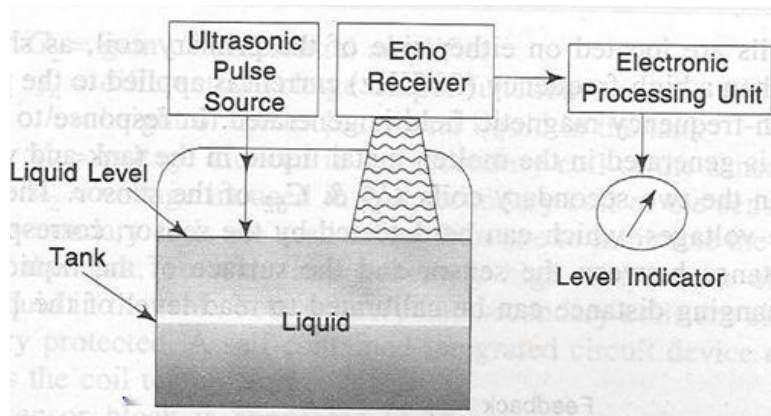
2M

(c) With neat diagram explain ultrasonic level measurement.

4M

Ans: Diagram:

2M



Explanation:

Ultrasonic level detectors operate either by the absorption of acoustic energy as it travels from source to receiver. It operates by generating an ultrasonic pulse and measuring the time it takes for the echo to return. Figure illustrates the working of an ultrasonic level detector.

Ultrasonic level detectors consist of a set of transmitter and receiver.

It is connected to electronic processing unit which calculates the time taken by ultrasonic wave to travel from Transmitter to receive.

Level Indicator is used to display liquid level.

The ultrasonic wave generated by transmitter is directed towards the liquid surface.

These waves get reflected by liquid surface and received by the receiver.

The time taken by the wave is a measure of the distance travelled by the wave.

$$T \propto h^2 \alpha (H-h)$$

Where t = time between transmitting and receiving pulses, H = distance between ultrasonic set and the bottom of the tank, h = distance between the ultrasonic set and surface of the contents in tank.

2M

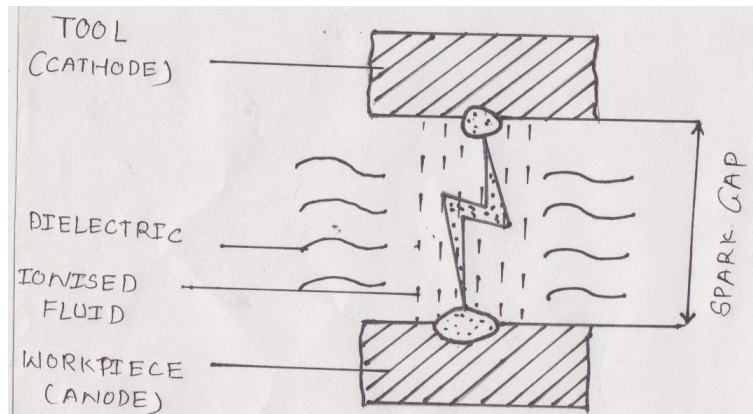
(d) Explain principle of EDM with appropriate diagram.

4M

Ans: Principle of EDM :

Electrical Discharge Machining (EDM) are a controlled metal-removal process that is used to remove metal by means of electric spark erosion. In this process an electric spark is used as the cutting tool to cut (erode) the work piece to produce the finished part to the desired shape. The metal-removal process is performed by applying a pulsating (ON/OFF) electrical charge of high-frequency current through the electrode to the work piece. This removes (erodes) very tiny pieces of metal from the work piece at a controlled rate.

Diagram :



2M

2M



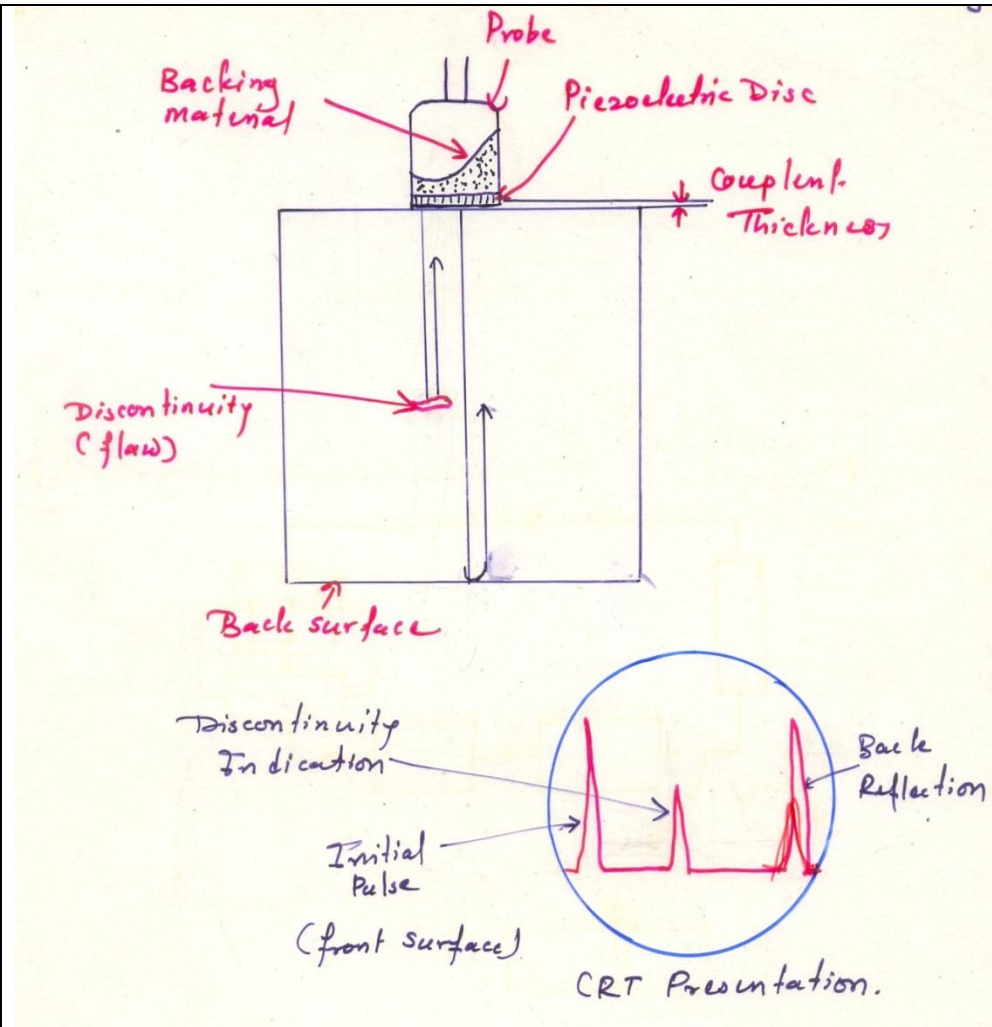
	(f)	Compare dielectric heating and induction heating.	4M																		
	Ans:	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Induction heating</th> <th style="width: 50%;">Dielectric heating</th> </tr> </thead> <tbody> <tr> <td>1. Used for heating magnetic materials</td> <td>Used for heating non-conductive materials</td> </tr> <tr> <td>2. Uses eddy current loss for heating.</td> <td>Uses dielectric losses for heating.</td> </tr> <tr> <td>3. Depth of penetration is an important factor.</td> <td>Distance between two conducting plates is an important factor.</td> </tr> <tr> <td>4. Used for surface heating</td> <td>Used for body heating</td> </tr> <tr> <td>5. Heat is produced is proportion to square of current.</td> <td>Heat produced depends on the square of voltage.</td> </tr> <tr> <td>6. . Frequency range from Hz to KHz</td> <td>Frequency range is in MHz</td> </tr> <tr> <td>7. It has no conduction, convection losses.</td> <td>It has losses like conduction, convection and radiation.</td> </tr> <tr> <td>8. Applications: Brazing, Surface hardening of steel, Annealing of brass& bronze</td> <td>Applications: Electronic sewing, Food processing, Gluing of wood</td> </tr> </tbody> </table>	Induction heating	Dielectric heating	1. Used for heating magnetic materials	Used for heating non-conductive materials	2. Uses eddy current loss for heating.	Uses dielectric losses for heating.	3. Depth of penetration is an important factor.	Distance between two conducting plates is an important factor.	4. Used for surface heating	Used for body heating	5. Heat is produced is proportion to square of current.	Heat produced depends on the square of voltage.	6. . Frequency range from Hz to KHz	Frequency range is in MHz	7. It has no conduction, convection losses.	It has losses like conduction, convection and radiation.	8. Applications: Brazing, Surface hardening of steel, Annealing of brass& bronze	Applications: Electronic sewing, Food processing, Gluing of wood	Any Four Points (1M Each)
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Q. 3		Attempt any FOUR :	16M																		
	(a)	List the problems of traditional industry.	4M																		
	Ans:	<ol style="list-style-type: none"> 1. Human dependency 2. Mass production is not possible 3. Poor Quality of finished goods 4. Complex machining 5. Slow production 6. High amount of wastage 7. Product is less reliable 	(Any four problems 1M each)																		
	(b)	What is NTM?List the type of energy used in NTM.	4M																		
	Ans:	<p>NTM :NTM is a non traditional machining in which some form of energy is used for machining and shaping materials instead of the traditional sharp –edged cutting tools.</p> <p>Types of NTM :</p> <p>Thermal and Electro-Thermal NTM :</p> <ol style="list-style-type: none"> 1. Electric Discharge machining (EDM) 2. Electron Beam machining (EBM) 3. Plasma Arc machining (PAM) 4. Laser Beam machining(LBM) 5. Ion Beam machining(IBM) <p>Chemical And Electro-Chemical NTM :</p> <p>Chemical machining(CHM) Electro-Chemical machining(ECM) Electro chemical grinding(ECG) Mechanical NTM Ultra Sonic machining (USM)</p>	NTM- 1M Types -3M																		



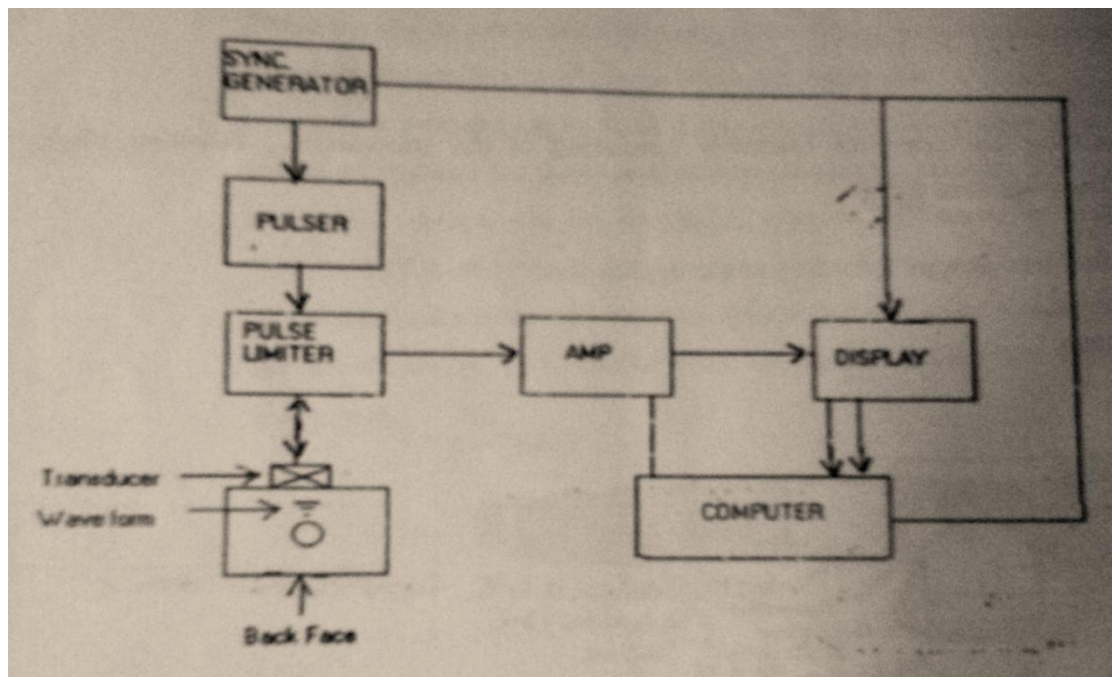
		Abrasive Jet machining (AJM) Water Jet machining (WJM)	
	(c)	What is couplant?List the requirement of good couplant.	4M
	Ans:	<ul style="list-style-type: none">• A couplant is a material (usually liquid) that facilitates the transmission of ultrasonic energy from the transducer into the test specimen. Couplant is generally necessary because the acoustic impedance mismatch between air and solids.• Requirement of good couplant :<ol style="list-style-type: none">1.The layer of couplant should be thin otherwise it will not give desirable results.2. The couplant should be non toxic,non corrosive and inflammable.3. Special couplants are used for high temperature applications.	Couplant: 2M Requirement :2 M
	d)	Why localized magnetization is needed?List the methods of localized magnetization.	4M
	Ans:	When the job size is very big then it is not possible to magnetize whole job at a time.In such cases defects are tested by selecting part of the job. This method is called as localized magnetization.It increases efficiency of testing. methods of localized magnetization are <ol style="list-style-type: none">1.Prod magnetization method.2.Torroidal magnetization method.3.Horse shoe magnetization method.	Need:2M methods:2M
	(e)	What are the functions of dielectric fluid used in EDM?List the dielectric fluids used in EDM.	4M
	Ans:	<u>Functions of dielectric fluid :</u> It is used to flow between work piece & tool that is in the spark gap to concentrate the heat energy generated in the spark on selected area. It is a spark conductor to concentrate heat energy to very narrow region of work piece. It acts as a Coolant to cool the electrodes and the work piece & to quench spark. It is a flushing medium for removal of small particles produced in machining process. <u>Dielectric fluids used in EDM :</u> <ol style="list-style-type: none">1.Kerosene2.Distilled water	Function:2 M, List:2 M
Q. 4	A)	Attempt any FOUR :	16M
	(i)	What are the causes of accident in industry?	4M
	Ans:	<ul style="list-style-type: none">• Poor quality of illumination.• Work methods.• Long hours of work.	(Any four causes:1M each)



	<ul style="list-style-type: none">• Fatigue.• Immature age of workers.• Inexperience.• Bad state of health.• Un favorable emotional & mental conditions.• Bad outlay of work place.• Un safe practices associated with the job.• Faulty equipment.• Lack of concentration in work.• Poor discipline.• Slippery floor.• Un guarded machines.• Poor house keeping.• Improper working conditions	
(ii)	Explain the principle of pulse-echo method of ultrasonic flaw detector with appropriate diagram.	4M
Ans:	<p><u>Principle of U.F.D:</u> A short burst and high vibrations are (sound wave trains)are generated with the help of piezoelectric element in the probe head and are transmitted into the material under the test.</p> <p>In case there is any discontinuity in the material, it will cause an acoustic impedance mismatch in the path of the sound wave due to which the sound wave energy will be reflected back to the transducer.</p> <p>Reflected sound waves (echo) is converted by the transducer into electric energy.</p> <p>The echo amplitude and time of travel through the material are indicated on the screen of the flow detector.</p> <p>The time interval is α^{n-1} to the distance of flow from test surface.</p>	Diagram:2M, Explanation: 2M



OR



- Fig shows the schematic diagram of pulse echo ultrasonic flow detector. In this method a transducer is kept in contact with workplace. Initially, the transducer works as a transmitter and gives out ultrasonic waves of desired frequency. Ultrasonic wave packets are made to pass through job piece. During this, transducer works as a receiver. Wave will travel to the back face of work piece and be reflected back to the transmitter. Any discontinuity in the beam area will produce other reflection.

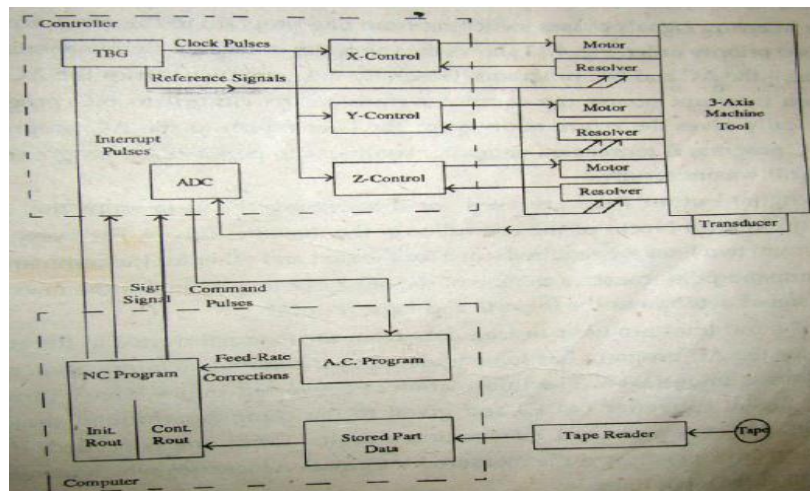
The functions of various blocks are as follows-

1. Sync Generator: this block generates synchronization signal for pulser, CRT display and computer.
2. Pulser : It is used to generate designed frequency.
3. Pulse Limiter : It is used to control amplitude of ultrasonic wave generated.
4. Amplifier: It receives the reflected wave and amplifies it to drive the display.
5. Display: CRT display is used for displaying transmitted pulse which gives position of flow in work piece.
6. Computer : Computer can be a part of flow detector which will allow user to store number of sets of result for later calculation and other analysis.

(iii) Draw the block diagram of CNC machine and explain in brief.

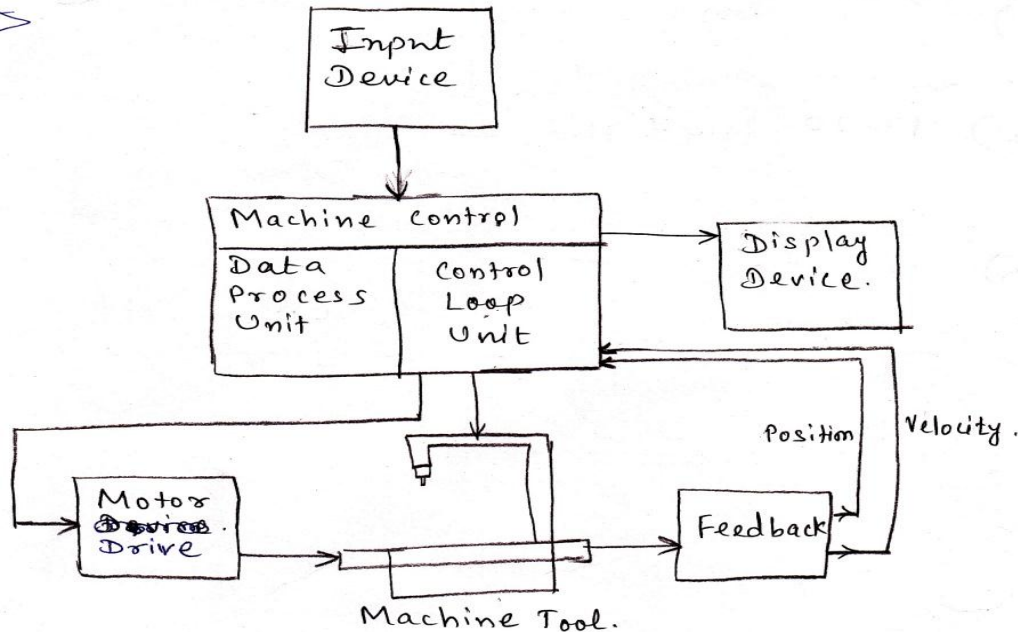
4M

Ans: Block diagram of CNC machine



**Block diagram:2M,
Explanation: 2M.**

OR



Explanation:

Input Device:

- It can either be a floppy drive or USB flash drive, etc.
- The part program and other relevant data like work piece design image are stored in these.
- The data is further passed to the machine control unit.

Machine control unit:

- It is the heart of CNC
- All the motion, cutting etc., actions are controlled and coordinated by MCU
- MCU can be divided in two parts Data processing and control loop unit.
- The Data is accepted and understood by the data processing unit and according to this data control loop drives the motor drives.

Motor drives

- It is the control system for all the motors involved in the CNC.
- It operates the one single motor or more motors at a time as per the requirement of the program

Machine tool:

- It is the label and tool assembly.
- The work piece is mounted on the table and appropriate action is performed over it using different tools.
- In CNC's either the work piece is stationary and tool is moving or other way round.
- All the motion cutting machining take place in actual in this reaction as per the program

Feedback devices :

- This device operates on the continuous feedback available from the machine tool.

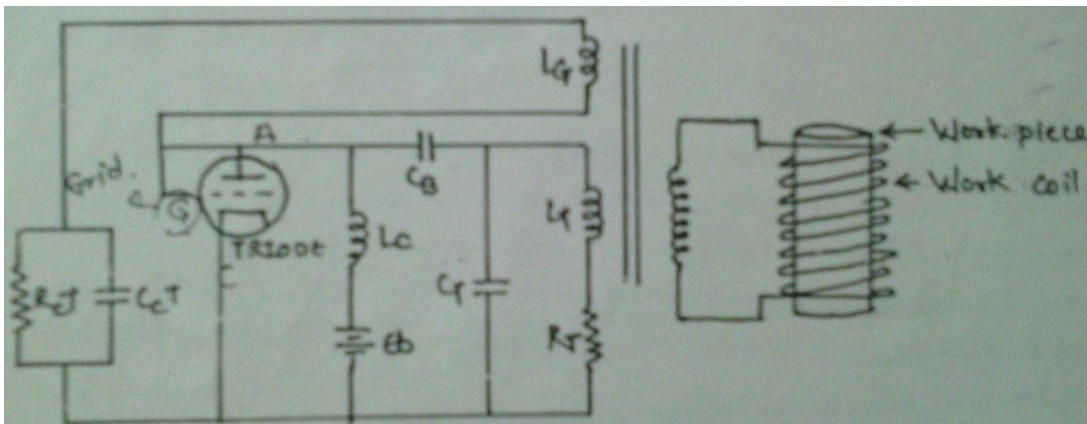
- For accurate and precise machining CNC's use closed loop system in which constant feedback is available.
 - They compare the actual displacement, motion etc. with that of the references or base point and provide feedback.
 - Two feedback position and velocity feedback are provided.
 - Depending on both the feedback the control loop unit decides the action to be taken in case of error.
 - Same time the velocity of motor change or sometimes the position of tools is checked.
- Display Devices:**
- In a CNC all elements work in proper synchronization and all elements contribute equally.
 - The display device may be a CRT or LCD display.
 - It displays the part programs and other data like the design image of the work piece being machined, finished work piece etc.
 - It here by enables the observer to keep a checked follow the process whether the machining is being done properly or not.
 - If at or any error is detected in the programs, it is display which be rectified accordingly.

(iv) **Draw the power supply oscillator ckt. For induction heating.Explain its working.**

4M

Ans: Power supply oscillator ckt for induction heating:

**Diagram:2
M,Explanation:
n:2M.**



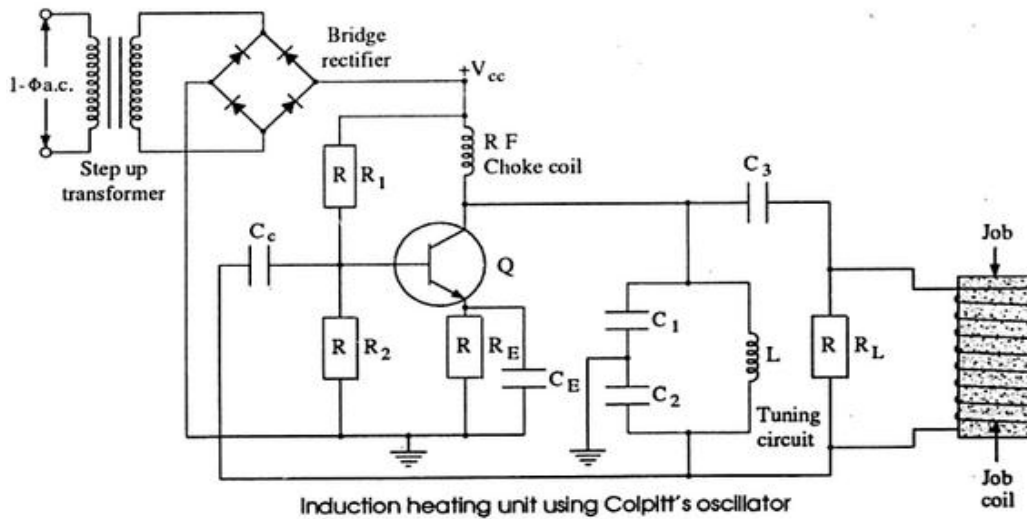
Circuit details:

- Above circuit shows tuned plate oscillator used in induction heaters. Triode tube is replaced by transistors in modern oscillators.
- Inductor L_1 in parallel with C_1 forms tank circuit. This tank circuit is connected to anode of the triode through a capacitor C_B called the blocking capacitor.
- When the DC power supply E_B is switched on, triode starts conducting.
- Tuned circuit picks up the relevant harmonic from the transient and thus generates an oscillation across it, which is AC in nature.
- A part of this AC signal is fed back to the grid of the tube by means of the coupling coil L_G .
- Positive feedback is achieved through grid anode action of triode and feedback by

coupling coil.

- A parallel combination of L_G and C_G has been used to maintain a proper negative bias for the triode. L_C is a choke coil, which is provided for the purpose of isolation in the tube.
- A required frequency can be obtained from this circuit by properly choosing values of different components used.

OR



Circuit Detail:

- The figure shows an induction heating unit using colpitts oscillator circuit.
- The AC voltage available across the mains is stepped up by a step-up transformer and is rectified with the help of a bridge rectifier. The DC output available is fed to the oscillator circuit.
- Oscillator circuit is built around the transistor Q. RF choke coil is used for isolation.
- Inductor L along with C_1 and C_2 constitute the tank or the tuning circuit.

Operation:

- When supply is given, transistor starts conducting. The voltage generated across C_2 of the tank circuit is fed back to the base of Q by means of capacitor C_R .
- A phase-shift of 180° is obtained by transistor and another 180° by capacitor c_2 of tuning circuit. This causes a total phase-shift of 360 degrees which result in positive feedback causing building of oscillations.
- Frequency of these oscillations is given by

$$f = \frac{1}{2\pi\sqrt{LCr}}$$

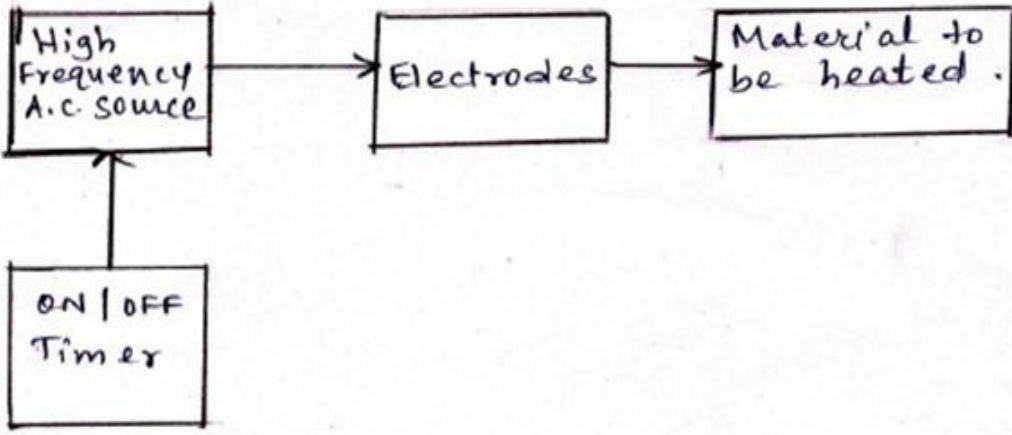
Where,

$$Cr = \frac{C1 \times C2}{C1 + C2}$$

- This high frequency alternating current is used for heating process. The work coil is wound around on the job. Two ends of the work coil are connected across the load resistor R_L .

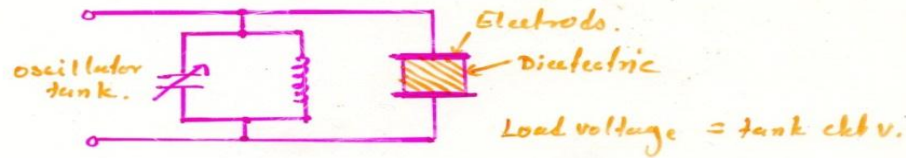
B) Attempt any One:

6M

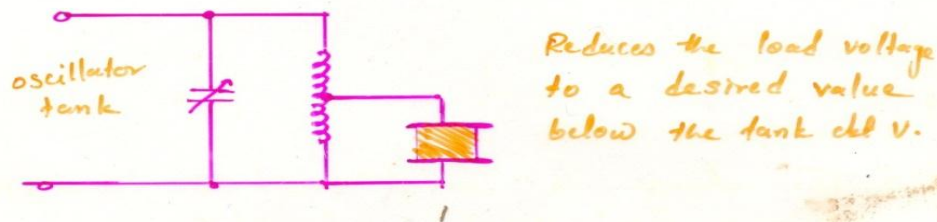
(i)	<p>Draw and explain the block diagram dielectric heating. Explain different methods of connecting electrodes to the tank circuit.</p>	<p>6M</p>
<p>Ans:</p>	<p><u>Block diagram of dielectric heating:</u></p>  <pre> graph LR A[High Frequency A.C. Source] --> B[Electrodes] B --> C[Material to be heated.] D[ON/OFF Timer] --> A </pre> <p><u>Explanation:</u></p> <p>The block diagram of dielectric heating consists of high freq. ac source which provide alternating current to electrodes.</p> <p>The material to be heated (job) is placed between the two electrodes which may be parallel plates.</p> <p>The job acts as a Dielectric between two electrodes of capacitor.</p> <p>During charging and discharging of the capacitor, the molecular arrangement of the job changes because of continuous stress created by the electric field.</p> <p>The current drawn by it is never leading the voltage by exactly 90 degrees.</p> <p>The angle between current and voltage is less than 90 degrees as a result of which there is small change in phase component of the current.</p> <p>This current produces power loss in a Dielectric of a capacitor. This power loss increases with the increase in frequency.</p> <p>This change in molecular arrangement results in generation of heat in the job.</p> <p>The reset timer is used to switch the power source on and off for heating and cooling processes. The timer operation may be fixed time or according to the feedback used in process</p> <p>Different methods of connecting electrodes to the tank circuit are :</p>	<p>(Diagram:2 M,Explanation:2M, methods:2M)</p>

Methods of Coupling Electrodes

a) Electrode directly across the tank coil.



b) Load across part of tank coil.



c) Auxiliary inductor in series with load.



d) Load Connected through transmission Line.

(ii) **What is NC word? Explain in brief types of words use in manual part programming.**

6M

Ans: **NC word:** A NC word is a collection of characters used to form an instruction. A typical NC word consist of X- position, Y – position feed rate etc.
1.N – Word (sequence number)
 The sequence number is used to identify the block and the 1st word in every block is the sequence no.

2.G – Word (preparatory function)

The preparatory word prepares the control unit to execute the instruction that are to follow.

3.Co- ordinate (X, Y, & Z words)

These words give final co- ordinate positions for X, Y, & Z motions. The words I, J, K are used to specify the position of arc center in case of circular interpolation.

4.Feed function (F – word)

The feed function is used to specify the feed rate in the machining operation.

5.Spindle speed function (S – Word)

The spindle speed is specified either in revolutions per minutes (rpm) or

(NC word:2M, Types:1/2M each.)



		<p>as mm per minutes.</p> <p>6.Tool selection function (T –word) The T - word is needed only for m/c s with programmable tool turret or automatic tool change (ATC).</p> <p>7.Miscellaneous function (M – word) The Miscellaneous function word is used to specify certain Miscellaneous or auxiliary function which do not relate to the dimensional movements of the machine.</p> <p>8.End of block (EOB) The EOB symbol identifies the end of instructions block.</p>	
Q.5		Attempt any FOUR	16M
	a)	Give the classification of CNC machine	4M
	Ans:	<p><u>1.Based on feedback :</u></p> <ul style="list-style-type: none"> • Open loop • Closed loop <ul style="list-style-type: none"> a) Velocity feedback b) Positional feedback <p><u>2. Based on control system features :</u></p> <ul style="list-style-type: none"> • Point to point • Straight line • Continuous path <p><u>3. Based on the co-ordinate system :</u></p> <ul style="list-style-type: none"> • Incremental • Absolute <p><u>4.Based on the structure of control system :</u></p> <ul style="list-style-type: none"> • Analog • Digital 	1M Each Type
	b)	Draw the block diagram of ultrasonic cleaner and explain it.	4M
	Ans:	<p><u>Diagram:-</u></p> <div style="text-align: center;"> <pre> graph LR A[Electrical Generator] --> B[Ultrasonic Transducer] B --> C[Suitable Solvent] C --> D[Job for Cleaning] </pre> </div>	1M



	<p>longer.</p> <ul style="list-style-type: none">This method of demagnetizing was developed to overcome the limitations presented by the AC demagnetizing method where part geometry and certain alloys prevented the AC demagnetizing method from working. <p><u>Halfwave DC demagnetizing (HWDC):</u></p> <ul style="list-style-type: none">This process is identical to full-wave DC demagnetizing except the waveform is halfwave.This method is only found on single-phase AC/HWDC power supplies.	
(e)	List the advantages and disadvantages of EDM.	4M
Ans:	<p><u>Advantages of EDM :</u></p> <ul style="list-style-type: none">High surface finishHigh material removal rate.High accuracy.Complex part can be machined. <p><u>Disadvantages of EDM :</u></p> <ul style="list-style-type: none">Expensive.The wear rate of electrode is higher so more than one electrode is required.Machining time is much longer.High specific power consumption	2M Any Two Points 2M Any Two Points
(f)	Explain surface hardening of steel using induction heating.	4M
Ans:	<p><u>Diagram:-</u></p> <pre>graph TD; A[ON OFF TIMER] --> B[HIGH FREQUENCY AC SOURCE]; B --> C[WORK COIL]; C --> D[STEEL OBJECT TO BE SURFACE HARDENED]</pre> <p><u>Explanation:</u></p> <ul style="list-style-type: none">Is the process of hardening the surface of a metal object while allowing the metal deeper underneath to remain soft, thus forming a thin layer of harder metal (called the "case") at the surface.The object to be surface harden is kept in helical coil (work coil) made of tubing.A heavy current at high frequency about 400 KHz is passed through the work coil for about 5 - 10 sec.When the temperature of the surface up to desired depth reach the required level,	2M 2M



	<p>2. Strippable Lacquer film :</p> <ul style="list-style-type: none">• The clear liquor is spread on the indication• After drying, the liquor has been developed as plastic film developer to which indications are slicked.• Then it is stripped of the surface. <p>In this indications are obtained without loss of clarity as compared to transparent plastic tape method.</p>	
c)	Explain wet and dry method of inspection	4M
Ans:	<p><u>Dry method:</u></p> <p>i) Dry particle inspection is well suited for the inspection which is on a rough surface. ii) In this magnetic particle technology. Dry particles are dusted on to the surface of test object as the item is magnetized. iii) Pulsating DC current creates a pulsating magnetic field that provides mobility of the power. iv) Dry particle inspection is also used to detect sub surface cracks.</p> <p><u>Wet method:</u></p> <p>i) This method involves applying the magnetic particle while they are suspended in liquid carrier. ii) Suspension is also available in dry so that the surface can be quickly and easily covered with uniform layer of particles. iii) The liquid carrier provides mobility to particles with extended period of time which allows enough particles to float to small leakage field to form a visible indication.</p>	2M 2M
d)	What types of feedback used in closed loop NC system? What is their need? Explain.	4M
Ans:	<p><u>The types of feedback used in closed loop NC system are :</u></p> <p>1. Velocity feedback 2. Positional feedback</p> <p><u>Explanation :</u></p> <p><u>1.Velocity feedback:</u></p> <ul style="list-style-type: none">• Measures and monitor the speed of the drive motor.• Tacho generator is used in this system• It gives voltage output which is proportional to its speed.• Rotary encoders are also used to provide feedback for velocity control. <p><u>2.Positional feedback:</u></p> <ul style="list-style-type: none">• Measures and monitors the position or displacement of the machine slides.• The position measuring devices used are either rotary or linear transducers.	1M 3M
e)	Explain use of following G and M words G00,G90,M03,G01.	4M
Ans:	<p>1. G00:Rapid Traverse It is the preparatory code which prepares the control unit to execute the instruction</p>	1M Each



to follow Rapid transverse. All the movements in the rapid transverse are perform at maximum feed rate available on CNC machine tool, which depends on design of machine.

2. **G90:**Absolute programming
3. **M03:** starts clockwise rotation of spindle.
4. **G01:**Linear movement

straight line move with speed defined by an F. if moving in multiple axes, the machine will move proportionally in each axis until it reaches its defined and positionA