Code -

G. S. Mandal's

Maharashtra Institute of Technology, Aurangabad

(An Autonomous Institute)

END SEMESTER EXAMINATION

Second Year B. Tech (ME) -Feb/Mar-2023

Course Code: MED 204 **Course Name: Manufacturing Processes**

Duration: 2 Hrs **Max. Marks: 50** **Date:**

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S.No.	Sub Q.No.		Marks
1	a	**Properties of Moulding Sand** Moulding sand should possess the following properties: 1. Porosity 2. Flowability 3. Collapsibility 4. Adhesiveness 5. Cohesiveness or strength 6. Refractoriness	2 marks
	b	1. Carbide tipped drill 2. Oil hole drill 3. Step drill 4. Core drill	2 marks (1+1)
	c	The transducer converts the oscillating current to a mechanical vibration. Two types of transducers have been used in ultrasonic machining; either piezoelectric or magneto strictive.	2 marks (1+1)
	d	1. Edge cracks 2. Alligator cracks 3. Wavy edges 4. Zipper cracks 5. Center buckling	2 marks (1+1)
	e	Heat supplied in resistance welding (H) = I^2Rt Where, I is the current (Ampere), R is the resistance (ohm) and t is the time (s)	2 marks
	f	1. Vitrified 2. Silicate 3. Synthetic resin 4. Shellac 5. Rubber	2 marks

	g	Capstan and turrent lathe is preferred over conventional lathe due to some added advantages such as: 1. Headstock has more range of speeds and is heavier to allow for higher rate of production. 2. Tool post is indexable. 3. Two or more tools mounted on a single tool face can cut simultaneously. 4. Feed of each tool can be regulated by means of feed stops.		2 marks
	h	**UP MILLING MACHINE**	**DOWN MILLING MACHINE**	2 marks
		UP Milling is known as the Conventional Milling process.	Whereas, Down Milling is known as the Climb Milling process.	
		The cutting forces act upward in the UP Milling as you can see in the diagram.	Here the cutting forces act opposite to the up milling or you can say downward.	
		The UP-Milling process is used for rough purposes. Whereas,	Down Milling or Climb Milling Process is used for the final or finishing operation.	
2.		The electrical discharge machining working process is based on the generation of sparks and metal removal through spark erosion. EDM spark erosion is the same as when an electric spark strikes a piece of metal and burns a small hole into it. This process generates heat which causes metal to be removed through erosion and evaporation. During this machining procedure, the workpiece and the tool must be made of conductive materials. **Working:** In this process, work piece should be well electric conductive. Only electric conductive material can be machined by this method. The working of EDM is as follow: • First both work piece and tool are submerged into dielectric fluid. The dielectric fluid help to control the arc discharge. This also removes suspended particles of work piece material and tool from the work cavity. • A servomechanism is used which maintains a very small gap between the work piece and the tool. This gap is desirable for proper arc formation. It is about the thickness of human hair. • The tool is made as the opposite shape of work piece. • A high frequency current supplied to electrode, which produces a spark between the tool and work piece. This spark generates high in		8 marks

work cavity.

- The metal removed from the work piece due to erosion and evaporate ion.
- The chips or suspended particle between tool and work piece should be removed to prevent them to form bridge that causes short circuit. This is done by continuous supply of dielectric fluid.
- The EDM produce a cavity slightly larger than the electrode because of overcut.
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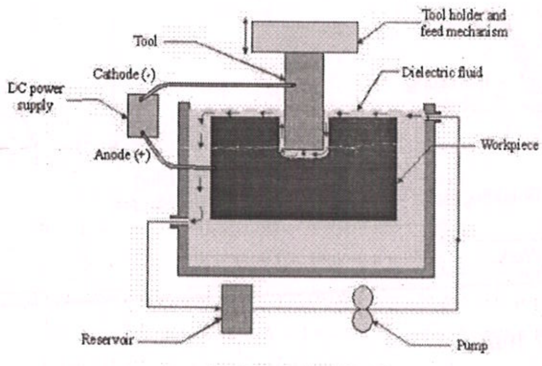
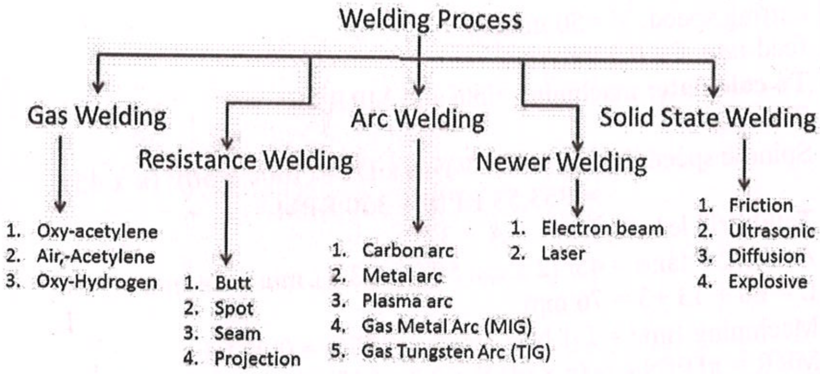


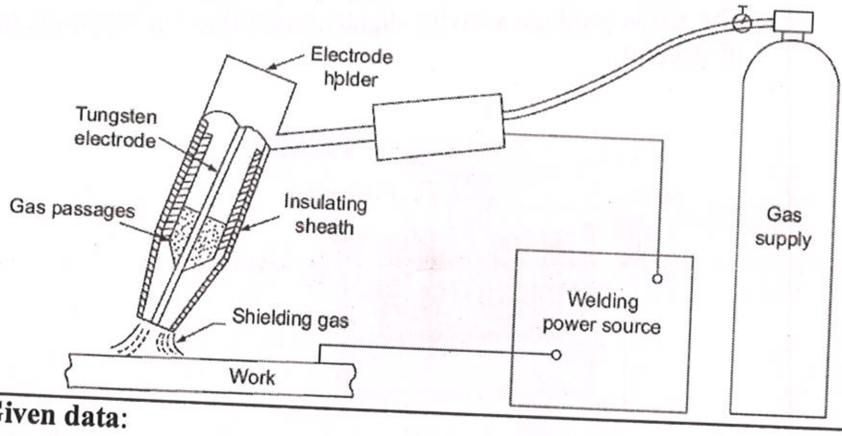
Figure: Schematic of EDM process

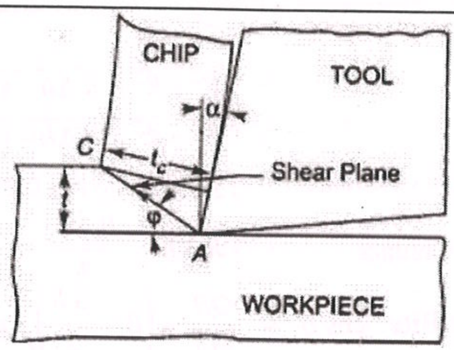
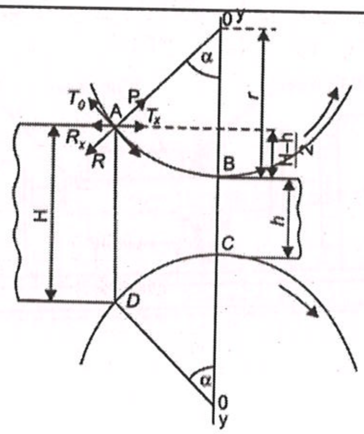
3. (8 marks)

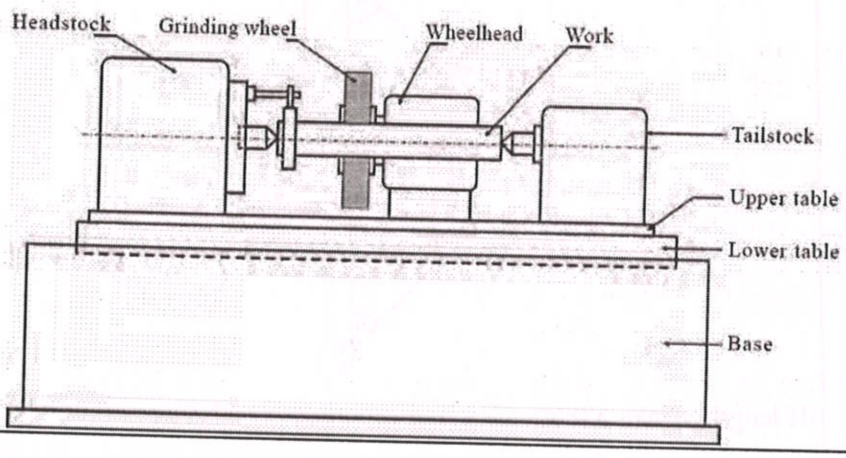


Tungsten inert gas (TIG) welding or gas tungsten arc welding (GTAW) is an inert gas shielded arc welding process using non-consumable electrode. The electrodes may also contain 1 to 2% thoria (thorium oxide) mixed along with the core tungsten or tungsten with 0.15 to 0.40% zirconia (zirconium oxide). The pure tungsten electrodes are less expensive but will carry less current. The thoriated tungsten electrodes carry high currents and are more desirable because they can strike and maintain a stable arc with relative ease. The zirconia added tungsten electrodes are better than pure tungsten but inferior to thoriated tungsten electrodes.

A typical tungsten inert gas welding setup is shown in Figure. It consists of a welding torch at the centre of which is the tungsten electrode. The inert gas is supplied to the welding zone through the annular path surrounding the tungsten electrode to effectively displace the atmosphere around the weld puddle. The smaller weld torches may

		not be provided with any cooling devices for the electrodes, as in Fig. 9.34, but larger ones are provided with circulating cooling water. The TIG welding process can be used for the joining of a number of materials though the most common ones are aluminium, magnesium and stainless steel. 	
4		**Given data:** hole diameter, D = 45 mm hole length, l = 60 mm lip angle, α = 59° cutting speed, V =50 m/min. feed rate, f = 0.3 mm/rev. **To calculate:** machining time and MRR? Solution: Spindle speed, $N = (1000 \times V)/(\pi \times D) = (1000 \times 50)/(\pi \times 45)$ $= 353.53$ RPM ~ 350 RPM Total drill length, $L = l + A + 3$ $A = D/2 \times \tan\alpha = 45/(2 \times \tan 59°) = 13.51$ mm ~ 13 mm $L = 60 + 13 + 3 = 76$ mm Machining time = $L/f N = 76/(0.3 \times 350) = 0.72$ min. MRR = $\pi D^2 fN/4 = (\pi \times (45)^2 \times 0.3 \times 350)/4 = 16.706 \times 10^3$ mm³/min	8 marks
5		**Assumption** Let shear plane angle is denoted by ϕ Let Rake angle is denoted by α Let thickness of chip before cutting is t Let thickness of chip after cutting is t_c Let chip thickness ratio (chip thickness before cutting /chip thickness after cutting) = r	8 marks

		 From figure: $t = AB \sin \phi$ $t_c = AB \cos(\phi - \alpha)$ **The chip thickness ratio, *r*, which is also termed as cutting ratio, would be** $r = \frac{t}{t_c} = \frac{\sin \varphi}{\cos(\varphi - \alpha)} = \frac{1}{\cot \varphi \cos \alpha + \sin \alpha}$ $\cot \varphi \cos \alpha = \frac{1 - \sin \alpha}{r}$ $\tan \varphi = \frac{r \cos \alpha}{1 - r \sin \alpha}$	
		OR	
5		 If length of Arc AB are projected to rolling plane A' B'	8 marks

		Then, $A'B' = A''B'' = AO^2 - BC^2$ $= \sqrt{R^2 - R^2 + R\Delta h - 0.25\Delta h^2}$ $= \sqrt{R^2 - R^2 + R\Delta h - 0.25\Delta h^2}$ Length of contact $= \sqrt{R\Delta h}$, leaving $0.25\,\Delta h^2$ being negligible Area of Contact $= \sqrt{R\Delta h} \times \frac{B+b}{2}$ Angle of Bite $\cos\alpha = \frac{OB}{OA} = \left(R - \frac{\Delta h}{2}\right)/R$ $\cos\alpha = 1 - \Delta h/2R$ or $1 - \Delta h/D$	
6		A grinding machine is a production machine tool used in the manufacturing industry in which the grinding wheel is attached in the tool post and the workpiece is fixed to the work table and when the operation starts it removes the unwanted material to get the desired surface finish, correct size, and accurate shape of the workpiece. The cylindrical grinding machine is used generally for producing external cylindrical surfaces. The machine is very similar to a centre lathe. The grinding wheel is located similar to the tool post, with an independent power driven at high speed suitable for grinding operation. Both the workpiece and the grinding wheel rotate counter clockwise. The workpiece that is normally held between centres is rotated at much lower speed compared to that of the grinding wheel. If the finished section to be ground is wider than the wheel, the wheel is fed in the transverse direction. Very fine finishes are obtained with cylindrical grinding. It is possible to get accuracies within 0.25 μm with extreme care. 	8 marks

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ISO Standards for Coding: — 8 marks

In the early years of development of Numerical Control standardisation has been given due importance. As a result many of the things that we use in NC are standardised and many of the manufacturers follow the standards to a great extent. One of the first things to be standardised is the word addresses to be used in programming. All the 26 letters of the English alphabet were standardised and given meaning as follows:

Character	Address For
A	Angular dimension around X axis
B	Angular dimension around Y axis
C	Angular dimension around Z axis
D	Angular dimension around special axis or third feed function*
E	Angular dimension around special axis or second feed function*
F	Feed function
G	Preparatory function
H	Unassigned
I	Distance to arc centre or thread lead parallel to X
J	Distance to arc centre or thread lead parallel to Y
K	Distance to arc centre or thread lead parallel to Z
L	Do not use
M	Miscellaneous function
N	Sequence number
O	Reference rewind stop
P	Third rapid traverse dimension or tertiary motion dimension parallel to X*
Q	Second rapid traverse dimension or tertiary motion dimension parallel to Y*
R	First rapid traverse dimension or tertiary motion dimension parallel to Z*
S	Spindle speed function
T	Tool function
U	Secondary motion dimension parallel to X*
V	Secondary motion dimension parallel to Y*
W	Secondary motion dimension parallel to Z*
X	Primary X motion dimension
Y	Primary Y motion dimension
Z	Primary Z motion dimension

* Where D, E, P, Q, R, U, V, and W are not used as indicated, they may be used elsewhere.

Advantages of CNC machines:

1. Parts can be produced in less time and thereafter are likely to be less expensive.
2. Parts can be produced more accurately even for smaller batches.
3. The operator involvement in part manufacture is reduced to minimum.
4. Inspection time is reduced.
5. Machining times and costs are predictable to a greater accuracy.

Paper setter 1

Paper Setter 2