

6TH SEM./MECH /DME /MECH(SAND) /MECH(IND.INTG)/ 2022(S)

Th4 Advance Manufacturing Processes

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1 & 2
Figures in the right-hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. How an Ultrasonic Machining tool removes the material?
 - b. Explain Encapsulation process.
 - c. What is meant by Manufacturing?
 - d. Define Additive Manufacturing process.
 - e. Name two process parameters that affect extrusion of plastics.
 - f. What is Concurrent Engineering?
 - g. What is meant by processability of plastics?
 - h. State the purpose of Maintenance.
 - i. State the layouts of Special Purpose Machining.
 - j. State the full form of LASER.

2. Answer **Any Six** Questions 6 x 5
 - a. Discuss about Calendaring process with sketch.
 - b. Compare Additive Manufacturing with CNC.
 - c. Discuss about Abrasive Jet Machining Process with diagram.
 - d. Explain Repair cycle.
 - e. What is Total Productive Maintenance?
 - f. Explain Injection Moulding process with diagram.
 - g. Discuss about Special Purpose Machining.

3. Discuss about any two types of Thermoforming process with sketch. 10

4. Discuss about different types of Machine Tool maintenance. 10

5. Describe briefly about Blow Moulding Process with neat sketch. 10

6. Explain Electric Discharge Machining Process with neat sketch. 10

7. Discuss about the 3-D Printing process principle, materials, advantages and limitations with necessary diagram. 10

Advance Manufacturing Process

Qa) How an ultrasonic machining tool removes the material?

Ans: A tool is set directly above the workpiece and ultrasonically vibrated perpendicular to it. A slurry comprising hard abrasive particles is circulated constantly into the working zone, and the tool indirectly impacts the workpiece surface through these abrasive particles.

b) Explain Encapsulation process?

Ans: Encapsulation technology is method of enclosing materials into capsules before delivery into a system.

c) What is meant by Manufacturing?

Ans: Manufacturing is the process of turning raw materials or parts into finished goods through the use of tools, human labor, machinery and chemical processing.

Manufacturing is integral to the economy. Most products were handmade using human labour and were scarce before the industrial Revolution.

d) Define Additive Manufacturing process?

Ans: Additive manufacturing is the process of creating an object by building it one layer at a time.

It is the opposite of subtractive manufacturing, in which an object is created by cutting away at a solid block of material until the final product is complete.

e) Name two process parameters that affect extrusion of plastics?

Ans: The variable parameters of extrusion process are melt barrel temperature, screw speed, die temperature, take up and speed, water tank temperature, and die nozzle diameter.

b) What is concurrent engineering?

Ans: Concurrent engineering is a work methodology emphasizing the parallelization of tasks, which is sometimes called simultaneous engineering or integrated product development using an integrated product team approach.

b) State the purpose of Maintenance?

Ans: ~~The fundamental purpose of maintenance is to~~

Ans: The main purpose of regular maintenance is to ensure that all equipment required for production is operating at 100% efficiency at all times.

Through short daily inspection, cleaning, lubricating, and making minor adjustments, minor problems can be detected and corrected before they become a major problem that can be shut down a production line.

i) State the layout of Special purpose machining?

Ans: There are two layouts for special purpose machining.

1) Single station

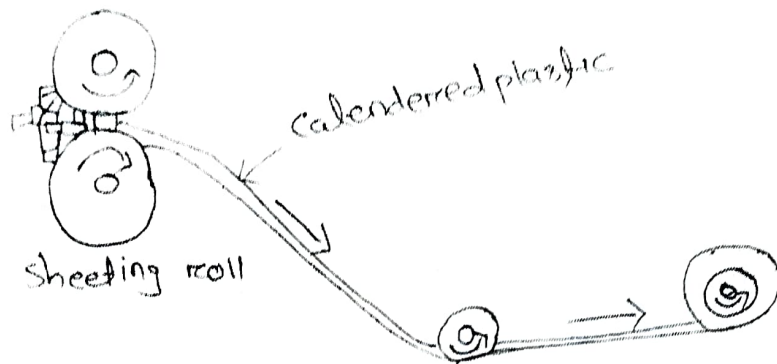
2) Multi-station.

Q) State the full form of LASER?

Ans: Laser is an acronym for "Light amplification by the stimulated emission of radiation".

Q) Discuss about calendaring process with sketch?

Ans:



(Forming sheet by calendaring)

- > An important method of making film and sheet is known as calendaring.
- > In this process the plastic compound (composed of resin, filler, plasticizer and colour pigment) is passed between a series of heated rollers as illustrated in figure.
- > It comes out from the rolls squeezed into film or sheet.
- > Thickness is controlled by a combination of squeezing and altering the speed of the finishing rolls.
- > The finished product is cooled by passing through water cooled rolls.
- > Vinyl floor tile, cellulose acetate sheeting and films are some of the applications.

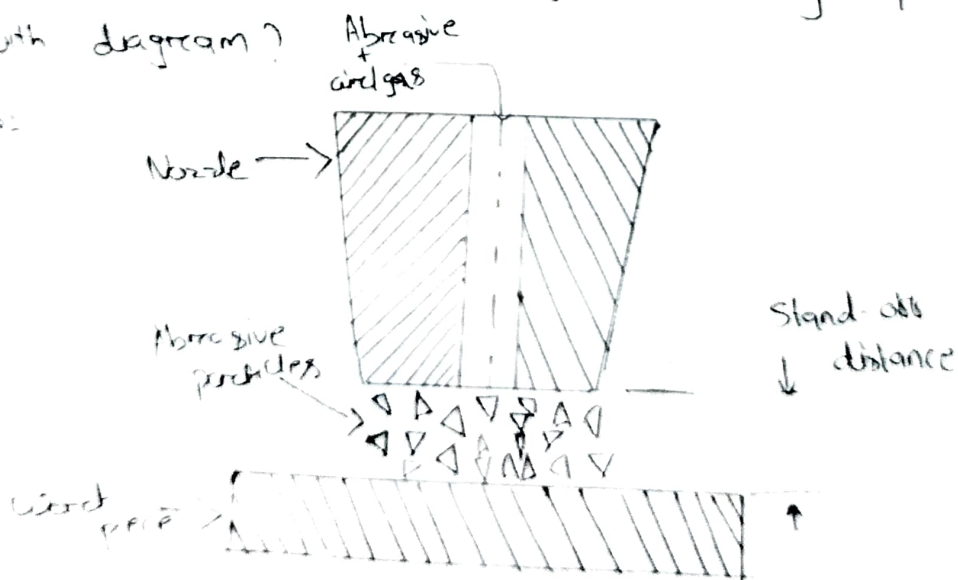
b) Compare Additive Manufacturing with CNC?

Ans: Additive Manufacturing vs CNC

- | | |
|---|---|
| <ul style="list-style-type: none"> → Based on subtractive method which is material is removed. → Based upon additive principle which is material is added layer by layer. → Does not require tooling system (tooling, fixtures etc). → Parts are parallelly processed to save time. → Comparatively slower in process construction. → AM is better for customized production. | <ul style="list-style-type: none"> → Nesting is not possible. → Require sophisticated tooling system (tool, jig, fixture etc). → Nesting is not possible. → Much faster process speed. → CNC is better for mass production owing less time and overall cost. |
|---|---|

c) Discuss about Abrasive jet machining process with diagram?

Ans:



→ In abrasive jet machining the metal removal is accomplished by the application of high speed stream of abrasive particles carried in a gaseous medium from a suitable nozzle.

→ This process can be used to cut intricate shapes in hard and brittle materials which are sensitive to heat.

→ Abrasive jet machining involve the use of a high speed jet of abrasive particles carried by a high pressure gas or air on the work surface through a nozzle as below

→ The abrasive particles act as cutting tool and the cutting force is provided by the high kinetic energy of the carrier gas.

→ The metal removal occurs due to erosion caused by the abrasive particles impacting the work surface at high speed.

→ After with repeated impacts small bits of material get loosened and a fresh surface is exposed to jet.

→ The stand off is the distance between the work surface and the nozzle tip.

→ It is usually kept between 0.1 to 10mm.

→ Material removal rate, geometry of cut, surface roughness and nozzle wear rate are partly influenced by the elements.

Q) Explain Repair cycle ?

Ans: Repair cycle refers to the stages through which a repairable item passes from the time its removal or replacement until it is reinstalled or placed in stock in a serviceable condition.

→ Purpose level of repair cycle analysis (LORA)

- The LORA process produces the final support for the system.
- It determines where each required maintenance action will be performed.
- The physical resources that must be available to support the performance of maintenance and what the support infrastructure must be capable of sustaining throughout the operational life of the system.
- The results of LORA are documented and used as the basis for the development of the physical resources for support of the system.

→ Types of Repair cycle analysis:-

- Economic
- Non-economic

→ Economic :-

- Addressed using cost models that calculated the possible costs of all support options and then identify the least-cost solution.
- Some then the total cost of each option can be compared to determine the lowest option in terms of long-term support over the life of the system.

→ Non-economic:

- Decision criteria are a list of rules or guidelines that are used to determine if there is an overriding reason why maintenance should be performed.
- Some organizations have policies that any item costing less than a predetermined price level will be discarded and replaced than be repaired.

→ Repair Complexity ↓

- In maintenance systems, complexity can be defined based on technical and managerial aspects of a maintenance project.
- Because relative complexity between two projects can be used as a yardstick for resource allocation between them, quantifying the complexity becomes important.

e) What is total productive Maintenance ?

Ans: Total productive maintenance (TPM) is a holistic approach to equipment maintenance that strives to achieve perfect production.

- TPM emphasizes proactive and preventive maintenance to maximize the operational efficiency of equipment.
- Analyzing the three letters of TPM.
 - Total: All encompassing maintenance and production individuals working together.
 - Productive: Production of goods and services that meet or exceed customer's expectation.
 - Maintenance: Keeping equipment and plant in as good as or better than the original condition at all times.

Thus TQM is having the current plant and equipment at its highest productive level through cooperation so all areas of organization.

TQM emphasizes on empowering operators to help maintain their equipment and there by creates a shared responsibility base equipment that encourage involvement by plant floor workers.

Q) Explain injection moulding process with diagram?

Ans: The injection moulding process is a manufacturing process used for producing parts are components by injecting molten material into the mold cavity.

- Injection moulding can be performed with only one or these materials like glass, plastics etc. and most commonly, thermoplastic polymers are used.
- It is applicable to thermoplastic materials only.

→ Parts of injection moulding process:

- Reciprocating Screw
- Granules
- Hopper
- Nozzle
- Fixed Pattern
- Mold cavity
- Moving pattern
- Final product

The reciprocating screw rotates by means of a motor and the reciprocating motion is provided by a hydraulic system.

- the roller is mounted on a frame which is supported by the machine bed.
- By the use of a special mechanism, the roller can be moved into the position of the machine.
- It acts as a guide to the workpiece and plastic granules to the roller.
- A mode at the moment of the roller and the roller is used to move the roller from the position of the machine to the position of the machine.
- It is the place where the workpiece is between the grid rollers and the roller of the generation of the roller.
- Thus the final product will be obtained after cooling.

Q) Discuss about Special Purpose Machining?

Ans: SPM, Special Purpose Machining is a machine, with specially designed tooling and a dedicated base mass producing the same product day in and out.

- A judicious combination of limit switches, sensors, pneumatic, automatic job change etc.
- Special purpose machining tools are designed and manufactured base operator jobs and the workpiece produced is high.
- Tool machining can be done in a very short time.
- The techniques base designing such machine work should be made different base mass used.

but miss production machines.

- A very keen judgment is required for purchase of such machines.

- In first case the machine may perform operation only one operation or more.

- Generally the special purpose machine will not be classified as those in which jobs remain fixed in one position and those in which job moves from one station to other.

- Jobbing intermittent motion transfer machine is very popular production machine and is described in brief below.

- Such a machine comprises a turret, on which possibly several heads are mounted to receive and make the components for working.