

S'07 : 6 FN : MC 406/PR 406 (1499)**MANUFACTURING TECHNOLOGY***Time : Three hours**Maximum marks : 100*

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

*All parts of a question (a, b, etc) should be
answered at one place.*

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Group A

1. (a) What are key elements in a manufacturing cycle?
What are the various factors considered before
selecting a manufacturing process? 2 + 3
- (b) What is high carbon steel? How is it different from
a low carbon steel? What are its applications? 1 + 2 + 2
- (c) What is tempering? How is it different from harde-
ning? Why does it follow after a hardening
process? 3 + 4 + 3

2. (a) What are the different stages of shrinkage of a casting? Distinguish between liquid shrinkage and solid shrinkage of castings and identify factors responsible for each. 1 + 6
- (b) What is a riser? Why is it used in a casting? Explain Chaine's method of riser design. 1 + 2 + 4
- (c) Write a short note on centrifugal casting. 6
3. (a) What is the significance of roll diameter with respect to roll separating force in rolling? 6
- (b) Differentiate between coining and embossing. 6
- (c) List the advantages of forging of metals. Why is press forging preferred to hammer forging? 5 + 3
4. Write short notes on the following: 4 × 5
- (a) Injection moulding of plastic
- (b) Rapid prototyping
- (c) Production of metal powder
- (d) Sintering of metal powder.

Group B

5. (a) How is a single point cutting tool specified? Distinguish between ASA and ORS system of single point cutting tools. 3 + 6
- (b) What are the uses of a cutting fluid? 5
- (c) Explain the system of specifying a grinding wheel. 6

6. (a) Explain the procedure of gear hobbing method. 6
- (b) Describe the lapping method of finishing operation. 6
- (c) Distinguish between the following non-traditional methods of machining processes: 2 × 4
- (i) ECM and EDM
- (ii) AJM and WJM.
7. (a) What is NC? How is it different from CNC? Discuss with reference to machine tools. 3 + 5
- (b) Distinguish between the following: 2 × 6
- (i) Primary drive and secondary drive
- (ii) Guideways and slideways.
8. (a) Differentiate between the following: 2 × 6
- (i) Brazing and soldering
- (ii) MIG and TIG.
- (b) Describe the method of electroslag welding. 8

Group C

9. Briefly answer the following: 2 × 10
- (i) Why is pure aluminium not a popular engineering material?
- (ii) What is draft allowance in a pattern?
- (iii) What happens if pouring time in casting is too high or too low?
- (iv) What is the composition of pearlite and ledeburite?

- (v) What are the advantages of cold working?
- (vi) Why is flux used in welding?
- (vii) What facilities are needed to cut screw threads in a lathe machine?
- (viii) How is chip velocity related with cutting velocity?
- (ix) Which unconventional process is used in machining aerofoil shaped compressor blades of an aero-engine?
- (x) What is DNC machining?

MANUFACTURING TECHNOLOGY

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Group A

1. (a) Explain in which respects does a pattern used in making a mold differ from a casting. 6
- (b) What are the principles of riser design? 6
- (c) State the reasons for the occurrence of shrinkage cavity, porosity and blowhole types of casting defects. 8
2. (a) Distinguish between welding, brazing and soldering. 8
- (b) What is the metallurgical difference between the fusion zone and the heat-affected zone in a welded joint? Give examples. 6

- (c) How is machinability determined? 6
3. (a) What is compaction in powder metallurgy? What changes do occur during compaction? 8
- (b) Briefly explain with a neat sketch, the process of metal extrusion. 6
- (c) What is the necessity of tempering treatment after hardening? How is tempering done? 6
4. (a) Distinguish between punching and blanking operations. What is the role of the clearance between the die and the punch in these two operations? 3+5
- (b) Explain how material is removed in USM. 6
- (c) For an orthogonal machining operation, derive the following formula:

$$\tan \phi = \frac{r \cos \alpha}{1 - r \sin \alpha}$$

where, ϕ = shear angle

α = rake angle

r = cutting ratio. 6

Group B

5. (a) Describe the steps involved in the investment casting process. What is the significance of the term 'investment'? 10
- (b) Enumerate the submerged-arc welding process. What are the merits and demerits of this process as compared to gas metal-arc welding process? 10
6. (a) Explain the principle of gear hobbing. 10
- (b) Describe the main features of CNC machines which distinguish them from conventional machines. 10
7. (a) Explain the effects of various parameters on the material removal rates in EDM. 10
- (b) Briefly discuss the rolling process and the influence of the process parameters on the quality of the final product. 10
8. (a) Discuss injection molding of plastics. 10
- (b) What are the characteristics of high velocity forming processes? Describe the explosive forming process. 10

Group C

9. Briefly answer the following: 2 × 10
- (i) What is the significance of sand grain size in a mold?
- (ii) What does bend test on a welded joint reveal?
- (iii) Why is annealing treatment done?
- (iv) What are the major functions of a cutting fluid used in a conventional machining process.
- (v) Give examples of some products where powder metallurgy is indispensable.
- (vi) Which materials are used in the manufacture of grinding wheels and what are their applications?
- (vii) State the properties of electrolytes used in the ECM process.

- (viii) Explain the principle of spring back associated with a bending operation.
- (ix) Classify engineering materials and state the basis of classification.
- (x) Name three solid phase and three fusion welding processes.

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Group A

1. (a) What are prominent materials used in various engineering applications? How are they selected for a particular application? 3+2
- (b) What do you understand by the term 'steel'? Explain the effect of each of the alloying element present in an alloy steel. 2+3
- (c) What are the methods used for hardening of low carbon steels? Explain with reasons. State the purposes served by quenching and tempering. 3+3+4
2. (a) Why is casting preferred over other manufacturing processes? What is a pattern? List the factors on which the types of patterns depend. 3+2+3

- (b) What is a core box? Explain with a neat sketch. 2+2
- (c) Explain briefly the following defects in casting:
(i) Blowholes, (ii) Misrun, (iii) Cold shut, and (iv) Mismatch. 4
- (d) Name the main types of furnaces used in foundries for melting various varieties of ferrous and non-ferrous metals and alloys. 4
3. (a) What is strain hardening? Differentiate between hot and cold working in metal forming. 2+7
- (b) How do you provide shear in blanking and piercing operations in sheet metal working? 3
- (c) Discuss the types of extrusion? Mention the applications of each type. Derive an expression for extrusion force under ideal conditions of deformation. 2+2+4
4. (a) What are thermoplastic materials? How do they differ from thermosetting materials? 2+2
- (b) Explain 'blow moulding' and 'thermo forming' methods of processing of plastics. 2+2
- (c) What are the types of rapid prototyping? Explain stereolithography technique in detail. 2+3
- (d) Explain the procedure of manufacturing parts by powder metallurgy. 4
- (e) Discuss the applications of drop forging and press forging. 3

Group B

5. (a) What are the desirable characteristics of a cutting tool material? Specify the tool signature as per ASA system of tool nomenclature. 4+4

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(2)

(Continued)

- (b) Discuss the methods of producing gears. Mention the relative merits and demerits of each method. 3+4
- (c) Describe honing method of finishing operation. 3
- (d) Why is a built-up edge on a tool undesirable? 2
6. (a) What are the functions served by a cutting fluid in metal cutting operation? 7
- (b) Differentiate between single and multipoint cutting operations. 3
- (c) How do you select a grinding wheel for a particular operation? 4
- (d) What is the need for development of unconventional methods of machining? 6
7. (a) Differentiate between NC and CNC machine tools. What do you understand by 'canned cycle' in manual part programming? 3+4
- (b) Explain, with a neat sketch, the principle and working of electrochemical machining (ECM) process. 7
- (c) What are heat-affected zones in welding? 2
- (d) Discuss the types of solid state welding processes and their applications. 4
8. (a) Give the classification of fusion welding processes. 6
- (b) How are the welded joints tested? 4
- (c) Differentiate between brazing and braze welding. 4
- (d) What are the applications of adhesive bonding? 3
- (e) Explain mechanical fastening processes. 3

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(3)

(Turn Over)

Group C

9. Briefly answer the following: 2 × 10
- (i) What is permeability ?
 - (ii) What is the purpose served by risers in sand casting ?
 - (iii) What is recrystallisation ?
 - (iv) What do you understand by 'draft' on forgings and why is it provided ?
 - (v) What are the defects in rolled products ?
 - (vi) What is sintering ?
 - (vii) What is hot machining ?
 - (viii) Indicate the sources of energy in the following processes (a) EDM, (b) USM, (c) LBM, and (d) ECM.
 - (ix) What is burnishing ?
 - (x) Name the fluxes used for welding of (a) copper and its alloys, and (b) cast iron.

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Use sketches wherever required.*

Group A

1. (a) What are the factors, to be considered for selection of materials, for manufacturing a machine component? 3
- (b) What are the different types of furnaces used for ferrous casting? Give sketch of *any one* of such furnaces with label. Also, mention its advantages. 8
- (c) What is pattern for casting? What are the allowances to be accounted for making pattern? 4
- (d) Evaluate the importance and functions of runner and riser. 5

2. (a) What are cold forming and hot forming? Enumerate those with their advantages and disadvantages. 6
- (b) Draw a neat sketch of a strip rolling process and show the salient features/locations by labelling. 4
- (c) Define angle of bite and neutral plane in context of rolling. 4
- (d) Identify a small element within the rolling zone and show different stresses and forces, active on it. Mention the assumptions made in this context. 6
3. (a) What are compound die and progressive die? Give suitable examples of the use of these dies. 6
- (b) Draw an illustrative sketch of explosive forming. Name some explosives used in explosive forming. 10
- (c) What are the differences between extrusion and drawing? 4
4. (a) Discuss, with suitable diagram(s), the process of injection moulding of plastic. What are the precautions to be taken in this process? 8+2
- (b) Name some common defects in sand casting and the method of their detection. 6
- (c) What is tempering of product after metal working? Explain its necessity. 4

Group B

5. (a) Show different angles of a single point cutting tool in ASA system with proper planes of projection. 6
- (b) A single point cutting tool has the nomenclature: 5-10-6-6-10-75-1 mm (ORS). Identify the terms. 3

- (c) Name some non-ferrous cutting tool materials with compositions. 4
- (d) What are the common methods of applying cutting fluid in machining of metals? 4
- (e) How the process of grinding differ from metal cutting? 3
6. (a) Write the points to be considered in designing a machine tool structure. 6
- (b) What is stick-slip motion and where it occurs in a machine tool? 4
- (c) Name the bonding materials and abrasives used in grinding wheel. 5
- (d) What is the meaning of
(50) - A - 54 - M - 5 - V - (30)
for a grinding wheel? 5
7. (a) Explain the mechanism of material removal in electro-chemical machining with the help of Faraday's law. 6
- (b) Draw a schematic set up of ECM unit with label. 6
- (c) List four advantages and four disadvantages of electric arc welding compared to flame welding. 4
- (d) Compare the processes of abrasive jet machining (AJM) and water jet machining (WJM). 4
8. (a) Explain machine origin, part origin and programme origin in NC control of machine tool. 6
- (b) What are open loop control and close loop control of NC machine? 4

- (c) A MS bar is turned with HSS tool and the tool life equation is

$$VT^{0.2} = 80$$

Determine the tool life for a cutting velocity of 40 m/min. If the desired tool life is 2 hr, compute the designed speed. 8

- (d) State desirable properties of the dielectric medium in EDM. 2

Group C

9. Answer the following with necessary sketches wherever required: 2 × 10

- (i) Heat affected zone in arc welding.
- (ii) Differences between soldering and brazing.
- (iii) Abrasives used in AJM.
- (iv) Mechanism of material removal in ultrasonic machining (USM).
- (v) Sintering in power metallurgy.
- (vi) Chip reduction ratio or cutting ratio in metal cutting.
- (vii) Punching and blanking operation.
- (viii) Shear angle of metal cutting.
- (ix) Function of coating of coated electrode.
- (x) Hobbing of gear.

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Group A

1. (a) Write a short note on different types of cast irons.
What are the selection criteria for each one? Give
examples of typical applications. 3+3+2
- (b) Briefly describe various methods of production of
metal powders needed for a powder metallurgy
process. 8
- (c) How is annealing different from normalising heat
treatments? 4
2. (a) What is investment casting? Briefly discuss various
steps involved in this process. 2+6
- (b) Explain the basic functions and principles of riser
design. 2+4

- (c) Explain, with examples, the differences between a casting and a pattern. 6
3. (a) Explain the two yield criteria based on which the mode of plastic deformation that a metal may undergo can be ascertained. 8
- (b) Derive an expression to estimate the extrusion force for a metal. State the assumptions made. 6+2
- (c) Differentiate between hot and cold working in metal forming. 4
4. (a) Describe an injection moulding process for production of plastic components. Give examples of industrial applications. 6+2
- (b) What is rapid prototyping? Briefly explain different techniques of rapid prototyping. 2+6
- (c) What is blow moulding? What are its applications? 2+2

Group B

5. (a) Give a comparison of various gear manufacturing methods in terms of their applications, accuracy and process. 8
- (b) Distinguish between the characteristics of different types of abrasives used in a grinding wheel. 8
- (c) Draw the sketch of a single point cutting tool and show its geometrical features. 4
6. (a) Give a comparative evaluation of various cutting tool materials. 8
- (b) What are the main applications of cutting fluids? How would you select a particular cutting fluid for any given application? 5+3

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(Continued)

- (c) Under what conditions a continuous chip is formed in metal cutting? 4
7. (a) Explain the advantages, limitations and applications of numerical controlled machine tools. 3+3+2
- (b) Discuss *four* main features of CNC machine tools which distinguish them from conventional machine tools. 6
- (c) Describe the primary and the secondary drives in a machine tool. 6
8. (a) Describe submerged arc welding process. 6
- (b) What are the criteria of selection of a welding process for any given application? 6
- (c) What is the principle of material removed in USM? 4
- (d) List the merits and demerits of EDM process. 4

Group C

9. Briefly answer the following: 10×2
- (i) Classify engineering materials and state one typical application of each of the materials.
- (ii) What is a master pattern used in a foundry?
- (iii) Differentiate between a blanking and a piercing operation.
- (iv) Why is soldering difficult on a grey cast iron?
- (v) State the properties of electrolytes used in ECM process.

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(Turn Over)

- (vi) What is a slideway in a machine tool?
- (vii) How is lapping different from broaching?
- (viii) Why are aluminium alloys not used in centrifugal casting process?
- (ix) What is orthogonal cutting?
- (x) How is solid state welding different from fusion welding?

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Group A

1. (a) Describe the effect of alloying elements on the pro-
perties of high speed steel. 7
- (b) Explain the theory of rolling. List the advantages of
a three high mill over a two high mill. 8
- (c) What is directional solidification ? Why is directional
solidifications required ? 5
2. (a) Explain die casting process with the help of a neat
sketch. 8
- (b) Discuss salient features of a gating system design with
suitable sketches. 8
- (c) Define true centrifugal casting process. 4

3. (a) Explain the following operations with their purpose :
(i) Annealing, (ii) tempering, (iii) normalising, and
(iv) induction hardening. 8
- (b) Compare relative merits and demerits of injection
moulding and compression moulding of plastics with
the help of neat sketches. 8
- (c) Illustrate the method of tooth-paste tube production. 4
4. (a) Explain the principle of explosive forming with a neat
sketch and enlist the applications of the process. 7
- (b) Describe briefly various methods of manufacturing
metal powders. Give *two* important properties of
metal powders. 8
- (c) Explain stretch forming process. 5

Group B

5. (a) How are grinding wheels specified? Discuss the
effects of following parameters on the performance
of a grinding wheel: 10
- (i) Type of abrasive and grain size ; and
- (ii) Type of bond and structure of the wheel.
- (b) What is an investment casting? Describe the steps
involved in making a casting by this process. 10
6. (a) Define the geometry of a single point cutting tool. How
do the geometrical elements affect the performance
in machining a given material? 10
- (b) Briefly explain *any three* methods that can be used
for designing a riser for a casting. Comment on the
limitations of those methods. 10

7. (a) Design and show the various passes required for
reducing a square billet of 200 mm × 200 mm
cross-section to a round bar of 10 mm in diameter. 10
- (b) Explain the principle and process of explosive
forming. 10
8. (a) What is abrasive jet machining? Discuss the effects
of various parameters on the performance in
machining. 10
- (b) How are metal powders produced for powder
metallurgy? Briefly state the limitations of each
method. 10

Group C

9. Answer the following in brief: 10 × 2
- (i) Give *three* advantages of a blind riser.
- (ii) Differentiate between counterboring and counter-
sinking operation.
- (iii) Name *six* cutting tool materials.
- (iv) Name *six* single and multipoint cutting operations.
- (v) Differentiate between neutral flame and carburising
flame.
- (vi) Enlist various types of iron and steel.
- (vii) What are thermoplastic plastics?
- (viii) Which factors determine the depth of case harde-
ning?
- (ix) What is honey-combing in casting?
- (x) Name pattern allowances.

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Group A

1. (a) Distinguish between a steel and a cast iron. Broadly classify steels and indicate their most common applications. 2+3+3
- (b) Explain the basic considerations in selecting a particular material for manufacturing a product. 7
- (c) Discuss the distinguishing features between a pattern and a casting. 5
2. (a) Discuss the differences between pressurized and unpressurized gating systems and justify their applications. 5+3
- (b) Justify the most appropriate shape of a riser from (i) ideal point of view, and (ii) practical point of view. 4+3
- (c) Explain the basic features of true centrifugal casting process. 5

3. (a) Explain briefly the mechanism of plastic deformation. 8
 (b) Compare open-and closed-die forging. Why is flash desirable in a closed-die forging? 4+3
 (c) Show that for most metals, the stress-strain ($\sigma - e$) relationship can be expressed as

$$\sigma = ae^n$$
 where a and n are constants. 5
4. (a) Describe basic features and sequences of operations for the blow moulding process. 8
 (b) Discuss the purpose of (i) compaction, and (ii) sintering in powder metallurgy process. Identify the process parameters. 2+2+3
 (c) Giving examples, mention about the purposes of heat treatment. 5

Group B

5. (a) With the help of suitable sketches of a single point cutting tool, identify the tool angles specified in ASA and NRS systems. 5+5
 (b) On what basis are the tool angles selected? Give examples and reasons. 10
6. (a) How are grinding wheels specified? 5
 (b) Explain the effects of various factors on the performance of a grinding wheel. 5
 (c) Explain the mechanism of material removal in EDM. Why is the workpiece made an anode in this process? 7+3
7. (a) Discuss the types and characteristics of primary and secondary drives in a machine tool. 10

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(Continued)

- (b) What purposes do guideways and sideways serve on a machine tool? What are their basic requirements? 6+4
8. (a) Differentiate between welding, brazing, soldering and adhesive bonding. Identify any one unique application of each one of them. 8+2
 (b) Explain the basic principle of electric arc welding. 5
 (c) Why are shielded metal-arc welding electrodes coated? 5

Group C

9. Answer the following in brief: 10 × 2
- (i) How is heat-affected zone in a welded joint different from fusion zone?
 (ii) What is the principle of material removal in EBM?
 (iii) For what reasons would you like to prefer a CNC machine tool as compared to a conventional machine tool.
 (iv) How does built-up-edge form on the tool face during machining?
 (v) How is gear hobbing done?
 (vi) What are the main objectives of rapid prototyping?
 (vii) Explain the need and the nature of clearance between punch and die.
 (viii) Distinguish between toughness, hardness and strength of a material.
 (ix) Identify *any three* important reasons for formation of shrinkage defects in a casting.
 (x) Name *any five* thermoplastic plastic materials.

S'10: 6 FN: MC 406/PR 406 (1499) (3)

AG--1,500

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Group A

1. (a) Explain why the understanding of manufacturing processes is essential for better products. 6
- (b) Compare the properties of hardness and toughness from the application viewpoint. Mention how one may choose these properties for a given application. 7
- (c) Distinguish between hardness and hardenability. Explain a method of measuring the hardenability of steel. 7
2. (a) Name *any two* allowances provided on the pattern for a sand casting and state the reasons why they are provided? 6

- (b) Describe the types of risers and their uses with suitable sketches. 6
- (c) Give examples of the typical products of the following processes: die-casting, centrifugal casting, permanent mould casting, and shell moulding. 8
3. (a) Explain the high velocity forming processes with a neat sketch. 6
- (b) What is angle of bite in rolling? Give an expression for specific roll pressure. 3+3
- (c) Compare the design of dies in blanking and punching operations. 4+4
4. (a) Describe blow moulding and compression moulding processes and give their applications. 8
- (b) Explain stereolithography technique of rapid prototyping. 6
- (c) Describe production of metal powders and the methods of producing metal powders. 6

Group B

5. (a) Describe the types of tool materials. Mention the specific application of each material. 6
- (b) How are the grinding wheels specified? 4
- (c) Explain the production of screw threads. 4
- (d) Explain the ASA, ORS and NRS system of tool nomenclature. 6

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(Continued)

6. (a) Explain the selection of cutting fluids for a given machining operation. 5
- (b) Describe the primary and secondary drives in a machine tool. 5
- (c) What is numerical control of machine tool? Differentiate between CNC and DNC machines. 6
- (d) Describe the finishing processes in machining. 4
7. (a) Describe the need for developing new machining methods. 5
- (b) Explain the principle of operation of EBM and LBM processes and mention their applications. 6
- (c) Describe the applications of mechanical fastening processes. 4
- (d) Differentiate between brazing and soldering operations. 5
8. (a) How do you select a welding process for a given application? 7
- (b) Explain the testing of welding joints. 4
- (c) Classify the fusion welding processes. 4
- (d) Discuss basic design considerations in welding. 5

Group C

9. (A) Fill in the blanks or write *yes* or *no* for the following: 10×1
- (i) Sand mould is an example of permanent mould.
- (ii) — allowance is provided to compensate for enlargement of mould cavity because of excessive rapping.

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(Turn Over)

- (iii) Investment casting is a process also known as the lost wax process or precision casting.
- (iv) Mismatch is shift of the individual parts of a casting with respect to each other.
- (v) Residual stresses are set up during — working.
- (vi) — casting has excellent surface finish and dimensional accuracy.
- (vii) — brazing process is good for mass scale.
- (viii) Striking voltage as compared to voltage during arc welding is —.
- (ix) — percent carbon steel is highly weldable.
- (x) Taylor's tool life equation is —.

(B) Answer/fill in the blanks for the following: 5 ×

- (i) When the cutting edge of the tool is held perpendicular to the cutting velocity, the process is called — cutting.
- (ii) The process of — consists of grinding the metallic oxide to a finally divided state and then reducing it by hydrogen or carbon monoxide.
- (iii) The plastics which require heat and pressure to mould them into shape are called — materials.
- (iv) — refers to heating a sheet of plastic material until it becomes soft and pliable and then forming it either by vacuum, by air pressure, or between matching mould halves.
- (v) The important factors which control sintering are:
(a) — (b) — and (c) —.

S'11:6 FN:MC 406/PR 406 (1499)**MANUFACTURING TECHNOLOGY***Time : Three hours**Maximum Marks : 100*

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain why white cast iron (CI) is more brittle than grey CI. Give applications. 5
- (b) Write the composition of low, medium and high carbon steels along with the applications of use. 5
- (c) Write the composition of following representations : 5
 - (i) 35 Mn 2 MO 45
 - (ii) T 75 W18 Cr 4 V1
 - (iii) T 103.

- (d) Explain the role of toughness, hardness and strength of a material. 5
2. (a) Define a pattern. Discuss various merits and limitations of each pattern materials used in pattern-making. 4
- (b) Discuss the properties of sand to be used in moulding to get sound casting. 4
- (c) Discuss the causes and remedies of following casting defects : 4 × 2
- (i) Blow hole
- (ii) Hot tear
- (iii) Cold shut
- (iv) Pin hole porosity.
- (d) Explain why (i) section of sprue reduces downward, and (ii) risers should be made with a high volume or surface area ratio. 4
3. (a) How does cold rolling differ from hot rolling in terms of the process and product. 5
- (b) (i) Explain machine forging, drop forging and smith forging. 4
- (ii) Define counter locking of forging dies. What are the causes and effects of counter locking ? 4
- (c) Explain the process of extrusion by drawing a neat sketch. Also, differentiate between impact extrusion and cold extrusion forging. 7

S'11 : 6 FN : MC 406/PR 406 (1499) (2) (Continued)

4. (a) Distinguish between (i) normalizing and annealing, and (ii) cementite and martensite. 3 + 3
- (b) Draw the TTT diagram and show the phase changes. 8
- (c) Distinguish between hardness and hardenability, and give one method of measuring the hardenability of steel. 6

Group B

5. (a) Write various requirements of machine tools, list various tool materials used with the condition of use and applications. 8
- (b) Explain the term 'Tool Signature'. Suggest a tool signature for a HSS tool according to ASA. 7
- (c) Discuss the effect of operating parameters on tool life and surface finish. 5
6. (a) Explain machine origin, part origin, and programme origin in NC control of machine tool. 5
- (b) What are open loop control and close loop control of NC machine ? 5
- (c) For a grinding wheel, write the meaning of the following symbols : 10
- (50) – A – 54 – M – 5 – V – (30)
7. (a) Draw a schematic set up of ECM unit with label, and explain the material removal process by ECM. 8

S'11 : 6 FN : MC 406/PR 406 (1499) (3) (Turn Over)

- (b) Compare the processes of abrasive jet machining (AJM) and water jet machining (WJM). 8
- (c) Write the process capabilities and limitations of LBM. 4
8. (a) Explain TIG and MIG system of arc welding. Write their applications and limitations. 10
- (b) Describe the effect of various welding parameters that control the metallurgical structure of the heat-affected zone in C 50 steel. 10

Group C

9. Answer the following in brief with necessary sketch : 10×2
- (i) Design consideration in casting
 - (ii) Drawing process and conditions of drawing operation
 - (iii) Uses of rapid prototyping
 - (iv) Sintering process and its application
 - (v) Difference between grinding and finishing operation
 - (vi) Role of cutting fluids
 - (vii) Setting on lathe machine for thread cutting operation (V thread)
 - (viii) Difference between brazing and soldering
 - (ix) High energy rate forming
 - (x) Importance of dressing of grinding wheels.

S' 12:6 FN:MC 406/PR 406 (1499)

MANUFACTURING TECHNOLOGY

Time : Three hours

Maximum Marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answers
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Justify the materials you would select for manufac-
turing of (i) sledge hammer, and (ii) machine tool
column. 3 + 3
- (b) In how many ways can you manufacture gears
found in a machine tool ? State *any one* unique
characteristic of each of those processes. 6
- (c) State compositions and applications of stainless
steels. 4
- (d) State the merits of a casting process. 4

(Turn Over)

2. (a) Differentiate between pressurized and unpressurized gating systems. 5
- (b) What is the principle of centrifugal casting process? What types of materials are most suitable and why? 5
- (c) What is the difference between a 'pattern' and a 'master pattern'? 5
- (d) Explain Chvorinov's principle of riser design. What are its limitations? 5
3. (a) Explain the process of extrusion with the help of a sketch. 5
- (b) Can you use a blanking punch for a piercing operation? Explain your answer. 5
- (c) Briefly explain the explosive forming process. 5
- (d) In which respects hot rolling would differ from cold rolling? 5
4. (a) How is annealing different from normalising? 5
- (b) What products are made in injection and blow moulding processes? Name *any one* unique feature of these two processes. 5
- (c) What is stereolithography? 5
- (d) Name the advantages and disadvantages of powder metallurgy processing. 5

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(2)

(Continued)

Group B

5. (a) How does the performance of an HSS tool differ from that of a ceramic tool? 5
- (b) How are grinding wheels specified? 5
- (c) What are the functions of cutting fluids in a machining operation? 4
- (d) Explain the ASA nomenclature of a single point cutting tool. 6
6. (a) What is a secondary drive in a machine tool? Why are secondary drives needed? 5
- (b) Are guideways and slideways same? Explain your answer. 5
- (c) What are open loop and close loop controls in NC machines? 5
- (d) State main features of DNC machining. 5
7. (a) Explain the characteristics of the abrasives used in AJM and USM. 5
- (b) Explain the principle of material removal in ECM process. 5
- (c) State the merits of the EBM and LBM processes. 5
- (d) State the process capabilities and applications of EDM process. 5
8. (a) Differentiate between welding, brazing and soldering. 5

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(3)

(Turn Over)

- (b) What is heat-affected zone in a welded joint?
Explain with reference to medium carbon steel. 5
- (c) What is the difference between the tools used in spot
resistance and seam resistance welding? 5
- (d) Which process would be selected for welding
aluminum welding? Why? 5

Group C

9. Briefly answer the following : 10 × 2
- (i) Define manufacturing cycle with the help of an
example.
- (ii) What is the main cause of blow hole in a casting?
How can a blow hole be identified?
- (iii) Define rapid prototyping technique.
- (iv) **Name different methods of production of metal
powders.**
- (v) What is deep drawing? Explain with a sketch.
- (vi) How would you cut square threads in a lathe
machine?
- (vii) What are the functions of shielding gases used in
the MIG welding?
- (viii) Why is edge preparation needed in welding ?
- (ix) State the principle of material removal in the ECG
process.
- (x) What is the difference between grinding and
finishing?

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(4)

AG

W'12: 6 FN: MC 406/PR 406 (1499)**MANUFACTURING TECHNOLOGY***Time : Three hours**Maximum Marks : 100*

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks

Group A

1. (a) Name engineering materials and discuss their selection criteria. 6
- (b) Explain following patterns : Loose piece pattern, gated pattern, and sweep pattern. 3 × 2
- (c) What is continuous casting ? Describe the process with the help of a neat diagram. 8
2. (a) Differentiate between true centrifugal casting and semi-centrifugal casting. Give applications of both the processes. 7
- (b) Explain two, three and four high mills with neat diagrams. 6

- (c) Enlist the advantages and limitations of hot working. 7
3. (a) Define the following heat treatment processes : Annealing, normalising, hardening, tempering, nitriding, and cyaniding. 6 × 1
- (b) Describe the processes of metal powder production. 7
- (c) Explain injection moulding process of plastics with the help of a neat diagram. 7
4. (a) Discuss electro-hydraulic forming process with a neat diagram. 8
- (b) Explain the salient features of riser design. 5
- (c) Illustrate and explain the difference between wire and tube drawing processes. 7

Group B

5. (a) Sketch a milling cutter and show its various elements and angles. 4
- (b) Describe tool nomenclature in ASA and ORS with suitable examples. 4
- (c) Differentiate between honing and buffing. 5
- (d) Name various tool materials and discuss the advantages of carbide over high speed steel and carbon steel. 7
6. (a) Explain various methods of screw thread production with their relative merits and demerits. 8
- (b) Name different types of chips and discuss the conditions under which they are formed. 5
- (c) Define guideway and slideway. Enlist the main

requirements to be fulfilled in the design of slideway bearings. 7

7. (a) Describe the working principle of AJM with the help of a neat diagram. 5
- (b) In what respect the electro-chemical grinding differs from ordinary grinding process ? 5
- (c) Differentiate between brazing and soldering. 5
- (d) Enlist the advantages of submerged arc welding. 5
8. (a) Name destructive and non-destructive testing methods of welded joints and explain one destructive and one non-destructive testing method. 7
- (b) Discuss process selection parameters for welded joints. 5
- (c) Explain the mechanism of metal transfer in MIG/MAG welding. 4
- (d) Compare the relative merits and demerits of welding over adhesive bonding. 4

Group C

9. Briefly answer the following : 10 × 2
- (i) What is DNC machining ?
- (ii) What are different types of stainless steels ?
- (iii) Enlist the advantages of blind riser.
- (iv) Differentiate between a mould and a die.
- (v) Define indexing.

- (vi) What is the role of sintering in powder metallurgy?
- (vii) Differentiate between direct and indirect extrusion.
- (viii) Give six applications of powder metallurgy.
- (ix) Sketch two gating systems.
- (x) Define rapid prototyping.

S'13 : 6 FN : MC 406/PR 406 (1499)

MANUFACTURING TECHNOLOGY

Time : Three hours

Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Based on what considerations would you select a manufacturing process for any given product ? Give examples. 6
- (b) What is a micro-alloyed steel ? What are its merits ? 6
- (c) In which respects normalising heat treatment process is different from annealing ? 8
2. (a) Explain the principles of riser design in respect of its shape, size and placement. 6
- (b) How is the shrinkage allowance on a pattern determined ? Explain with examples. 6
- (c) What is an investment casting process ? Why is it so named ? 8

3. (a) Explain the principles of die design for blanking and piercing operations. 6
- (b) How are rails manufactured? Describe the process. 6
- (c) What is the mechanism of metal flow in an extrusion process? What are the types of products suitable for extrusion process? 8
4. (a) What are the steps involved in the powder metallurgy process? Discuss the importance of each step. 6
- (b) Bring out the inherent differences between injection moulding and blow moulding. Name some of the products made by these two processes. 6
- (c) What is the purpose of using a rapid prototype technology? Enumerate the process where a laser beam can be used in producing a prototype. 8

Group B

5. (a) Discuss the capabilities of different tool materials used in metal cutting. 6
- (b) With the help of sketches, show the geometry of a single point cutting tool and explain the significance of each parameter. 6
- (c) How are screw threads manufactured by machining processes? Explain the salient features of those processes. 8
6. (a) Explain, with examples, the method of specifying a grinding wheel. 6
- (b) Discuss the functions of primary and secondary drives in machine tools. 6

- (c) What are main features of NC, CNC and DNC machine tools used for machining? 8
7. (a) What is abrasive jet machining? How do the characteristics of the abrasives affect the machining performance? 6
- (b) Compare EBM with LBM in respect of their machining capabilities. 6
- (c) Explain the mechanism of material removal in the EDM process. How do the EDM process parameters affect the material removal rate? 8
8. (a) Between MIG and SAW processes, which one can have higher deposition rate? Why? 6
- (b) How is brazing different from soldering? Explain the principle of liquid filler metal flow into the joint. 6
- (c) What is friction welding? How are rotation and pressure related in this process? 8

Group C

9. Answer briefly the following: 10 × 2
- (i) What is meant by a manufacturing cycle?
- (ii) What are the causes for blow hole formation in castings?
- (iii) Why are aluminium alloys not suitable for centrifugal casting process?
- (iv) What are merits and demerits of high velocity forming processes?
- (v) Why is tempering heat treatment done after quenching heat treatment?

- (vi) What are the desirable characteristics of a cutting fluid?
- (vii) What is buffing operation?
- (viii) Why is grey cast iron easier to machine than mild steel?
- (ix) What is heat-affected zone in welding and what is its significance?
- (x) What are the functions of a flux used in welding?

W'13 : 6 FN : MC 406/PR406 (1499)**MANUFACTURING TECHNOLOGY***Time : Three hours**Maximum Marks : 100*

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

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answered at one place.*

*Answer should be brief and to-the-point and be supplemented
with neat sketches. Unnecessary long answer may result in
loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What is the role of a manufacturing cycle in effective utilization of resources ? Discuss. 5
- (b) Write all the processes used to manufacture a steel glass used in your house. 10
- (c) Write composition of various types of steel used. Give examples. 5
2. (a) What are important aspects of gating design for casting ? How is the size of a gate decided ? Write the relation between gate and a sprue for the casting. 3 + 3 + 3
- (b) Describe various defects caused by pattern and mould box equipment in casting. 5

- (c) Draw a complete process of shell moulding. Write advantages and limitations of this process. 4 + 2
3. (a) Explain, with suitable neat sketches, the rolling and forging operations. 3 + 3
- (b) Explain the following terms : Embossing, stamping and punching operations. 3 × 2
- (c) What are various types of chips ? Under what condition each chip is formed ? 8
4. (a) Write various steps of thermo-forming and compression moulding processes. Also, give their limitations. 6 + 2
- (b) What is the role of rapid prototype in manufacturing ? How it affects the cost and quality of product manufactured ? 3 + 3
- (c) Briefly explain the compaction and sintering processes. Write their advantages and limitations. 4 + 2

Group B

5. (a) Write various gear manufacturing methods. Explain one of them with neat sketches. 4 + 3
- (b) If the point angle of a twist drill is unsymmetrical with the axis, then what type of a hole profile can be generated ? Draw the picture of imagined profile. 7
- (c) Write various abrasives used for various finishing operations. 6
6. (a) Enumerate some of the advantages of CNC system over conventional NC machines. 6
- (b) Discuss the special control features of a CNC system. Also, give a general configuration of the system. 4 + 3

- (c) Explain various primary and secondary drives. What are the specific conditions of their usage ? 3 + 4
7. (a) Name various new machining methods. Explain process capabilities and limitations of AJM, EDM, EBM and LBM. 3 + 5
- (b) Explain the USM process with a neat sketch. Write limitations of this process. 4 + 2
- (c) Write various properties required of the ECM electrolyte. Name some of the electrolytes used with their advantages. 4 + 2
8. (a) Explain the following : 3 × 2
- (i) Role of welding processes in the present age
- (ii) Use of coated rod in the a.c. welding
- (iii) Appearance and properties of neutral, reducing and oxidizing flame.
- (b) Discuss the causes and cures for (i) porosity, (ii) penetration, (iii) wrap-age, (iv) distortion, (v) poor fusion, (vi) cracking, and (vii) undercutting. 7 × 2

Group C

9. Answer the following in brief : 10 × 2
- (i) Criterion for selecting an effective manufacturing process
- (ii) Pattern allowances and their importance
- (iii) Plastic deformation and its importance
- (iv) Tool signature
- (v) Use of adhesive bonding

- (vi) Specification of a grinding wheel
- (vii) Usage of sintering process
- (viii) Role of cutting fluid
- (ix) Gear train and its application
- (x) What is mechanical fastening process ?

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