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ME—504

B. TECH

FIFTH SEMESTER EXAMINATION, 2002-2003

MANUFACTURING SCIENCE – II

Time : 3 Hours *Total Marks : 100*

Note :— Attempt ALL the questions.

1. (*a*) Distinguish in any THREE of the following :— (4×3=12)

   (*i*) Orthogonal and Oblique cuttings

   (*ii*) Machinability and Tool-life

   (*iii*) Crater wear and Flank wear of the tool

   (*iv*) Orthogonal and Normal rake systems of tool specification

   (*v*) Continuous and Discontinuous chips

   (*b*) A tool shape with 8° back rake and 45° side cutting edge angle has to be used under orthogonal cutting condition. The tangential component of cutting force is 480 N and the normal component of cutting force (i.e. thrust component) is 240 N. The cutting velocity is 100 m/min. Calculate —

   (*i*) the required side rake angle so that cutting is orthogonal; (2)

   (*ii*) the kinetic coefficient of friction and; (3)

   (*iii*) energy consumed in friction per unit volume of material removal, if the chip reduction coefficient is 2·75. (3)

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OR

(*b*) Draw Merchant's force circle diagram. Develop expression for power required in metal cutting and derive Merchant's shear angle relationship. (2+3+3=8)

2. (*a*) Answer any TWO of the following :— (5×2=10)

(*i*) How does a Turret lathe differ from a Capstan lathe ? What special tooling is associated with the turret lathe ?

(*ii*) What are the main differences between a shaper and a planer ? Which are the different drive mechanisms used in shaper ? Discuss any one in brief.

(*iii*) What is the function of indexing head as a milling machine attachment ? Giving example, explain its working.

(*iv*) With the help of a suitable sketch, describe the geometry of a twist drill and also explain, how drill sizes are designated.

(*b*) Either cemented carbide or ceramic (oxide) may be used as tool materials while machining medium is carbon steel. The Taylor's tool-life equations are :

(*i*) for carbide tool $VT^{0.25} = 800$

(*ii*) for ceramic (oxide) tool $VT^{1.25} = 8000$

Calculate the break-even speed above which ceramic (oxide) tool will give better tool-life. (10)

3. (*a*) Answer any TWO of the following :— (5 × 2=10)

(*i*) How are grinding wheels specified ? Clearly differentiate between grade and structure of a grinding wheel.

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(*ii*) What do you understand about any *Two* of the following :—

(*a*) Lapping

(*b*) Down milling

(*c*) Reaming

(*iii*) Discuss the wear mechanism of grinding wheel.

(*b*) Show that the chip length, l_s, in horizontal surface grinding, using grinding wheel of diameter, D, is given by,

$$l_s = \left(1 + \frac{v}{V}\right)\sqrt{dD},$$

where V is the wheel speed, v is the work speed and d is the in-feed. (10)

4. Answer any FOUR of the following :— (5×4=20)

(*a*) Describe the types of flames obtained in an oxy-acetylene gas welding process. Also, give their applications.

(*b*) State the important functions of flux coatings of electrodes used in manual metal arc welding process. Also, give the designation of coated electrode used in manual metal arc welding.

(*c*) What are the differences between TIG and MIG welding processes ?

(*d*) What is 'arc blow' ? Explain the causes of arc blow. How is the arc blow problem in AC-welding taken care of ?

(*e*) Distinguish between Seam welding and Spot welding. Explain, whether dissimilar metals can be welded by resistance welding. If so, give the necessary precautions.

(*f*) Giving suitable diagram, explain the atomic hydrogen welding process and also give its scope of application.

5. Answer any FOUR of the following :— (5×4=20)

(*a*) What is Ultrasonic Machining process ? Giving suitable sketch, describe its working and also give its scope of application.

(*b*) Explain the mechanics of material removal in Electro-Chemical Machining (ECM) process.

If current of 1500 amp. is used, determine the volume rate of material removal from the copper block. Take the density of copper as 8·96g/cm^3, valency 1 and gram atomic weight as 58·93.

(*c*) What is Electro-Discharge Machining (EDM) process ? Obtain the expression of material removal rate in EDM process in terms of the process parameters.

(*d*) What is Explosive Welding process ? Describe, in brief, giving its field of applications.

(*e*) What is Plasma Arc Welding process ? Giving suitable diagram, explain its working and also give its field of application.

(*f*) What is Electron Beam Machining (EBM) process ? With the help of a suitable sketch, explain its working. Also, give its limitations and scope of application.