

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY



FACULTY OF INDUSTRIAL TECHNOLOGY

INDUSTRIAL AND MANUFACTURING ENGINEERING DEPARTMENT

Bachelor of Engineering Honours Degree Industrial and Manufacturing Engineering

2nd Semester Main Examination

COURSE : Computer Aided Design/Computer Aided Manufacturing II

COURSE CODE : TIE 5211

DATE : May 2014

DURATION : 3 Hours

INSTRUCTIONS AND INFORMATION FOR THE CANDIDATES

1. Answer any **FOUR** questions (a maximum of TWO questions on each section) out of **SEVEN**.
2. Each question carries 25 marks.
3. Show all working.
4. This question paper comprises six (6) printed pages.

REQUIREMENTS

SECTION A

Answer Any TWO questions from this section

QUESTION 1

- (a) What is Process Planning and what are the steps followed in coming up with a process plan? [7]
- (b) Briefly explain the following Computer Aided Process Planning approaches:
 - (i) Generative CAPP, and [9]
 - (ii) Variant CAPP systems. [9]

QUESTION 2

- (a) Briefly discuss the main types of statements encountered on an APT programming language platform? [8]
- (b) How does CAPP facilitate the integration of CAD and CAM? [4]
- (c) Briefly explain Numerical Control (NC) of machine tools and its advantages. [7]
- (d) Discuss the main components of an NC system. [6]

QUESTION 3

- (i) Define CNC and DNC with the aid of suitable examples in relation to Computer Aided Manufacturing. [10]
- (ii) Elaborate the advantages and limitations of Computer Aided Manufacturing with the aid of suitable practical examples. [8]
- (iii) Explain how complex shaped components are easier to machine on a CNC machine too. Discuss with the aid of relevant examples and sketches. [7]

SECTION B

Attempt a maximum of TWO questions from this section

QUESTION 4

(a) Briefly outline six (6) main objectives for numerically controlling of machines tools.

[5]

(b) Write a concise part program to machine the component shown in Figure QU4.

Given that the Feed rate $F=0.2$ mm/rev for general roughing down and the spindle speed $S = 1000$ rpm using a tool T0101 for roughing to 0.2mm of final dimensions, while Federates $F=0.1$ mm/rev and the spindle speed $S = 1740$ rev/min using a tool T0303 for finishing.

Assume that the blank is Diameter 60 mm x 180 mm long. Grooving and threading spindle speeds respectively are 900 rpm and 100 rpm whilst the feed rate is 0.1 mm/rev in both instances. Tools T0404 and T0808 respectively are used for grooving and external metric thread cutting. The final machining operation is parting-off of the required machined piece from the unmachined blank piece held in the chuck. The parting-off tool (T0909), like the grooving tool has a tip width of 3 mm, and the parting-off is done at the spindle speed of 500 rpm with a feed rate of 0.5 mm/rev. The machine controller is a Sinumerik one.

[20]

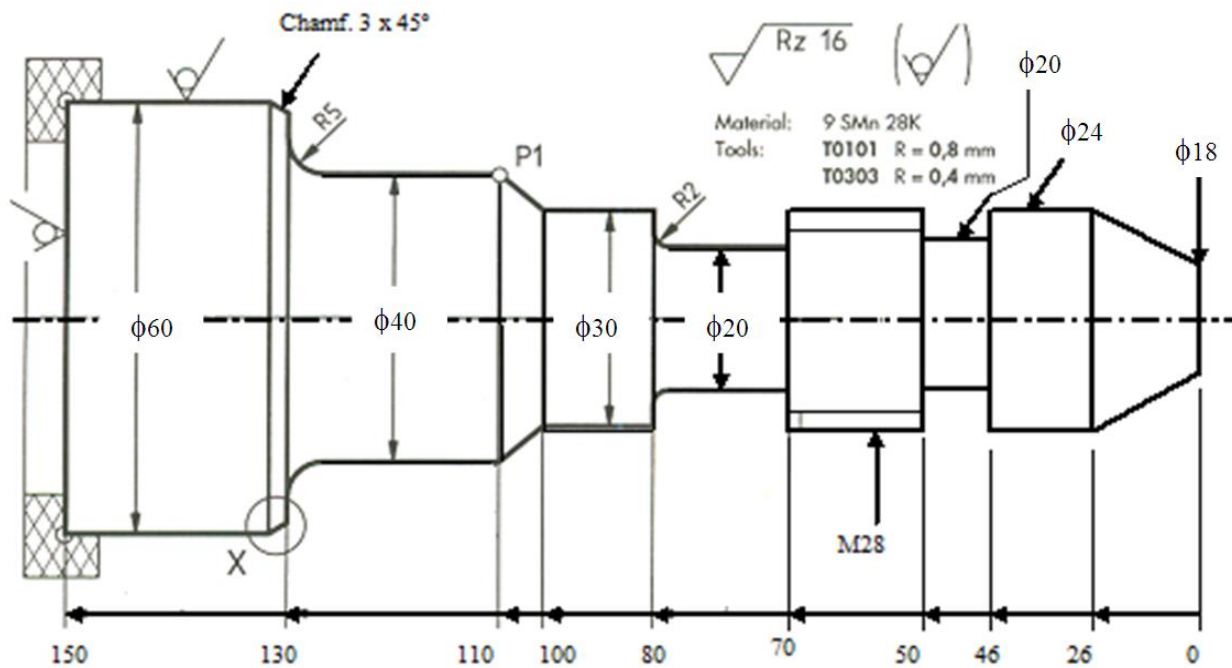


Figure QU4: Stepped Shaft

QUESTION 5

(a) Briefly explain the following terminology with the aid of examples where possible

(i) contouring machine motion [3]

(ii) modal and non-modal commands [3]

(iii) absolute and relative positioning commands [3]

(b) Write a concise part program to machine the component shown in Figure QU5 on a CNC milling machine. Given that the milling tool T2 which is of diameter 20 mm operates with a feedrate (F) = 80 mm/min and the spindle speed (S) = 1392 rev/min while the slot drilling tool T4 which is of diameter 8 mm operates with a feedrate (F) = 120 mm/min and spindle speed (S) = 1193 rev/min. Given also that the maximum depth of cut for the milling tool T4 is 6 mm. [16]

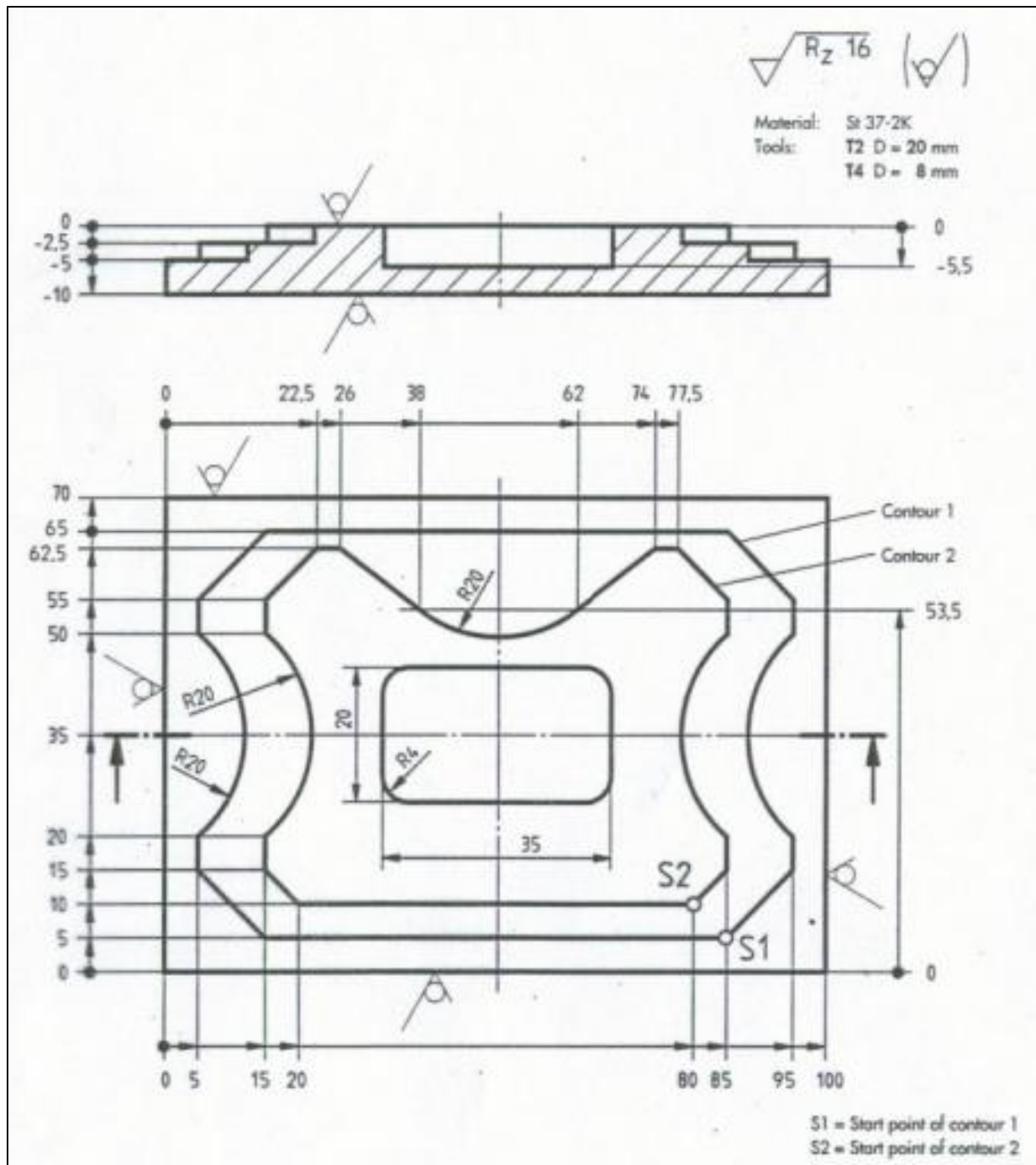


Figure QU5: Milled Plate

QUESTION 6

- Explain briefly what you understand by the term post-processor with the help of examples. [3]
- Briefly explain the components of CAM system. [5]
- Write a full APT program for machining of the profile shown in Figure QU6 which is 10 mm thick. The dimensions of the stock material are 250 x 150 x 10mm. The given

machining conditions and tooling are thus: a milling tool MT0202 of diameter 10 mm, operates at a feedrate (F) = 80 mm/min and spindle speed (S) = 477 rev/min. Any other relevant information not given can be assumed and stated in the solution. The profile is cut on a single pass at full depth. [17]

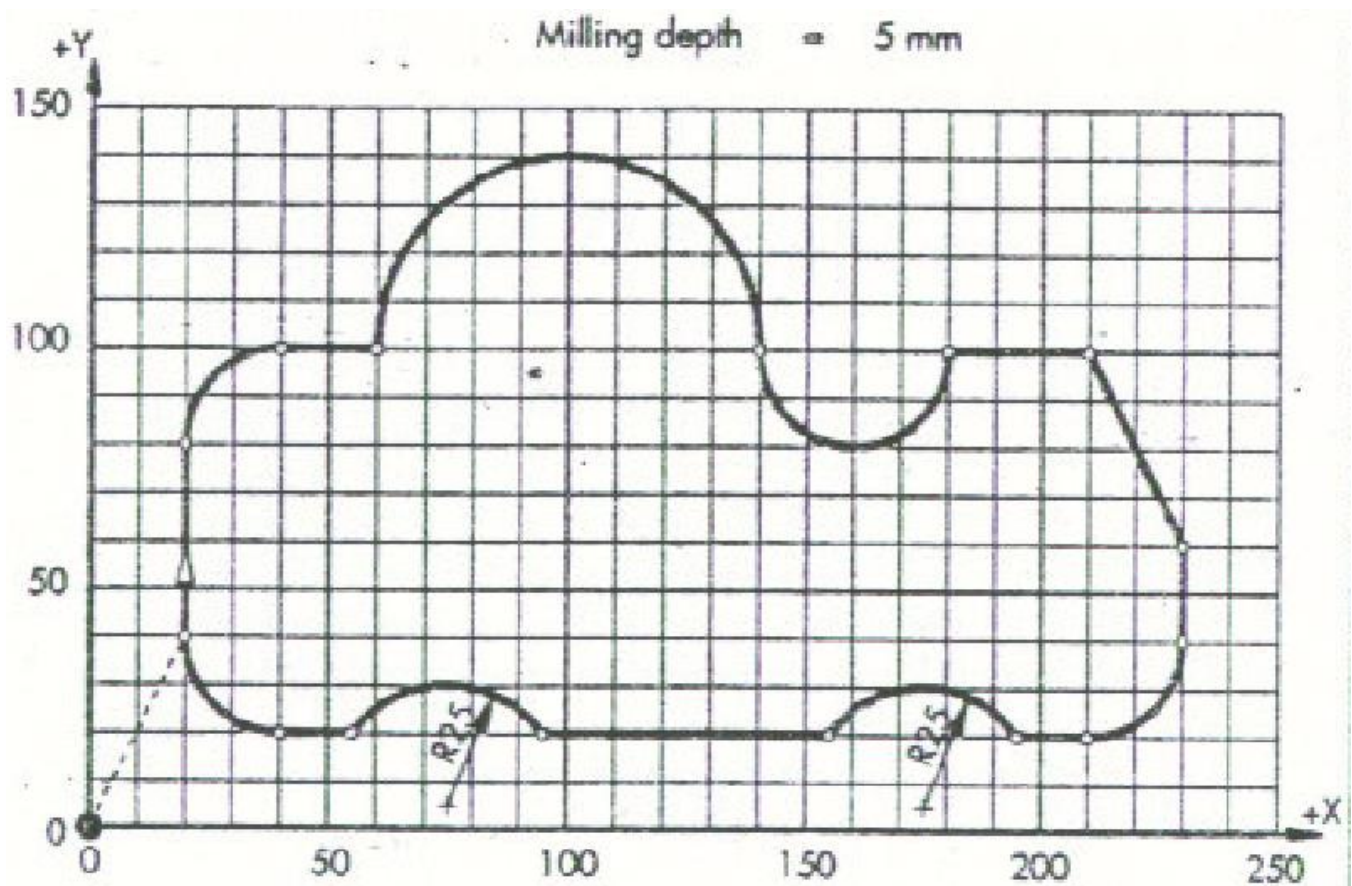


Figure QU6 Blending radii profile

QUESTION 7

- Outline how design impacts manufacturing as well as part cost and availability. [8]
- Discuss with the Aid of diagrams four Network Topological arrangements used for data exchange in Computer Aided Design /Computer Aided Manufacturing systems. [8]
- Discuss the assertion that automation and the use of high technological resources, as used through CAD/CAM platforms, to enhance design and manufacturing capabilities of entities cause unemployment in Zimbabwe as it is in the first world countries. [9]

..... **End of Examination**