Tertiary and Vocational Education Commission

Production Technology- Part I

NCT Equivalence Examination

Instructions:

01. This paper consist 05 questions.
02. Each question has part A and Part B.
03. Answer only one part of each question.

Duration: 03 Hours

1.0 Part A

i. Briefly explain the clearance and rake angles of cutting tool use for machining operation.

(04 marks)

ii. A single point cutting tool is use to rough parallel turning operation of an aluminum alloy round bar with a 13 mm diameter and 1.0 m length. The expected outside diameter of the bar after rough turning operation is 10.5 mm and the desired feed rate for the machining process is 2 mm/rev. Maximum allowable cutting speed for the cemented carbide tool and the high speed steel tool are 8 m/s & 3 m/s respectively. Compare the machining time for rough cut with above tools.

(06 marks)

iii. State linear measuring instruments which is having the least count of 0.02 mm or bellow.

(04 marks)

iv. Briefly explain the methods of obtaining engineering measurements by using **any two** of above instruments.

(06 marks)

1.0 Part B

i. Briefly explain the following
   a) Up milling and down milling. (04 marks)
   b) Blowhole and shrinkage in casting. (04 marks)
   c) Hot drawing and cold drawing. (04 marks)
ii. Explain the following sources of measurement **errors** with suitable examples
   a) Systematic error (04 marks)
   b) Application error (04 marks)

2.0 Part A

i.   The simply supported beam "AB" shown in the figure bellow subjected the point loads of 2500 kN & 1000 kN on "A" & "B" respectively. The section "BC" is subjected to a uniformly distributed load of 100 kN/m.
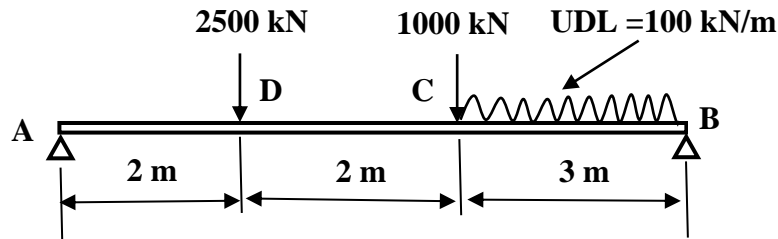
a)   Calculate the shear forces and bending moments acting on the beam.   (06 marks)

b)   Draw the bending moment diagram by selecting suitable scale.   (04 marks)

ii.   A solid disc flywheel having the mass of 12 kg and the diameter of 300mm. Its start rotating from rest and is driven an acceleration of 3 rad/s^2 during five minutes.

a)   Find the angular velocity and rotating speed of fly wheel after 5 minutes.

(03 marks)

b)   Moment of inertia of flywheel along the axis of rotation.   (02 marks)

c)   The kinetic energy stored in the flywheel during acceleration.   (03 marks)

d)   If the flywheel is brought to the rest with a uniform angular retardation of 2 rad/s2, find the time taken by the flywheel to come to rest.   (02 marks)
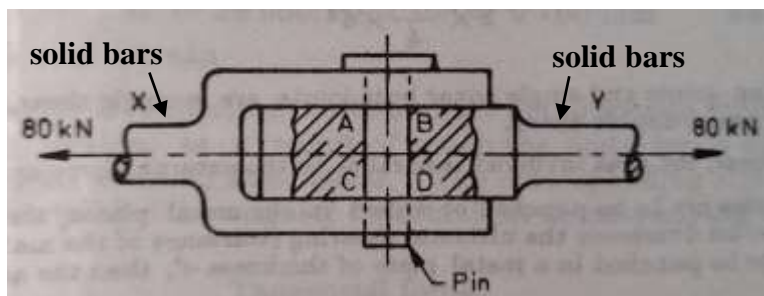
2.0 Part B

i.   A slider crank mechanism shown in the figure below. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find:

   a) Velocity of the slider A,

   b) Angular velocity of the connecting rod AB.
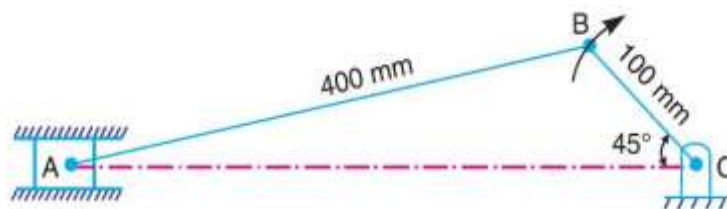
(10 Marks)

ii.   Solve the equation $2\cos^2\theta - \sin\theta = 1$ for the values of θ between 0 and 2π.   (04 marks)

iii.   Differentiate $y = \frac{(x+2)(3x+3)^2}{x}$ with respect to x.   (03 marks)

iv.   Determine $\int (3 + 2x + \frac{2}{5x^2} + 3x^4)\, dx$ (03 marks)

3.0 Part A

a) Draw the stress and strain diagram for ductile material and briefly explain the change of properties using the above diagram. (08 marks)

08 Define the term **Factor of Safety**. (03 marks)

09 Two circular **solid bars** (**X & Y**) made of shaft steel are connected by a pin joint and it is subjected to tensile load of 80 kN as shown in the figure bellow. Ultimate tensile stress of the shaft steel use to manufacture the bar is 240×10^6 N/m^2 and factor of safety is given as 2. Maximum permissible shear stress of the material made of **Pin** is 85×10^6 N/m^2. Calculate the **pin** and **bar** diameters suitable to design the pin joint.

(09 marks)

3.0 Part B

i.   The figure indicates schematic diagram of a reverted gear train made from spur gear wheels. Number of teeth in gear A, B, & C are 40, 60 & 30 respectively. Module number of all gear wheels are equal and the drive speed of the wheel "A is 1500 rpm. The input power on the wheel A is 2.5kW and efficiency of each gear pair is 98%. Calculate,
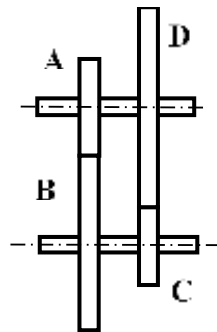
a) No of teeth on gear "D". (03 marks)

b) Speed and the torque on the output gear "D". (07 marks)

ii.   Briefly explain **three** mechanical properties of materials (06 marks)

iii.   List out the physical properties of materials (04 marks)

4.0 Part A

i. Draw, orthographic first angle projection drawing (**front** and **end elevations**) of assembled nut and bolt. Specification of the bolt is given as M 20 x 120mm and threaded length is 80 mm. (10 marks)

ii.
   a) Explain the duties and responsibilities of safety officers assign in a production plant. (06 marks)

   b) What is an injury? (02 marks)

   c) What is First Aid? (02 marks)

4.0 Part B

i. An engineering fit is defined in a manufacturing drawing as follows.

   Shaft Φ $30.000^{+0.040}_{-0.040}$ mm   Hole Φ $30.000^{+0.090}_{+0.050}$ mm

   Interpret the,
   a) Acceptable Shaft and Hole dimensions. (04 marks)
   b) Maximum and minimum clearances of the shaft and hole. (04 marks)
   c) Type of fit use for the above engineering fit. (02 marks)

ii. "Good housekeeping in the production plant may help to minimize the accidents". Explain the validity of the above statement with examples. (06 marks)

iii. State the Personnel Protective Equipment **(PPE)** should be use by the arc welder (04 marks)

5.0 Part A

i. What is CAD software? State the CAD software use in production technology. (04 marks)

ii. What is CAM software? State the CAM software use in production technology. (04 marks)

iii. Objectives should be "SMART". Explain the validity of the above statement with suitable examples. (04 marks)

iv. State the barriers for effective communication in an organization. (04 marks)

5.0 Part B

i. What is meant by computer network? (04 marks)

ii. State the advantages of computer networking? (05 marks)

iii. State the communication channels use for **formal** communication in production plants?

(06 marks)

iv.   How do you utilized the computer network and formal channels mentioned above for effective communication by minimizing printed documents?   (05 marks)