



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 4 Examination in Engineering: December 2015

Module Number: ME4303

Module Name: Manufacturing Engineering

[Three Hours]

[Answer all questions, each question carries twelve marks]

State the assumptions where necessary and do the calculations stating the units. All the notations have usual meaning.

- Q1. a) What are the direct and indirect factors which influence in machining? [1.5 Marks]
- b) Briefly describe three types of chips with neat sketches available in metal cutting. [1.5 Marks]
- c) In machining operation, none of the four force components F , N , N_s and S can be directly measured. However two force components F_v and F_t acting against the tool can be measured by using a dynamometer, a force measuring device.
- (i) Define the forces denotes by F , N , N_s , S , F_v and F_t .
- (ii) With aid of neat diagram show geometric relationships between forces and derive four equations for the four forces F , N , N_s and S .
- (ii) With aid of suitable sketches show that the shear strain on shear plane is equals to, $\gamma = \tan(\phi - \alpha) + \cot(\phi)$. [5.0 Marks]
- d) In an orthogonal cutting operation, the tool has a rake angle = 15° . The chip thickness before the cut = 0.30 mm and the cut yields a deformed chip thickness 0.65 mm. Calculate,
- (i) The shear plane angle,
- (ii) The shear strain. [4.0 Marks]
- Q2. a) With aid of suitable sketches briefly describe the difference between orthogonal cutting and oblique cutting methodologies. [1.5 Marks]
- b) What are the primary and secondary functions of the cutting fluids? [1.5 Marks]
- c) Compare Ultrasonic Machining and Abrasive Water Jet Machining. [1.5 Marks]
- d) Briefly explain the specific field of applications in Electrical Discharge Machining. [1.5 Marks]

e) Based on the Taylor's Tool Life Equation, describe the parameters that affect the life of a tool. [2.0 Marks]

f) Tool life tests in turning yield the following data:
(1) When cutting speed is 100m/min, tool life is 10 min,
(2) When cutting speed is 75 m/min, tool life is 30 min.
Determine,
(i) The n and C values in the Taylor tool life equation,
(ii) The tool life for a speed of 110 m/min,
(iii) The speed corresponding to a tool life of 15 min.

[4.0 Marks]

Q3. a) What are the requirements of a good moulding sand?

[2.0 Marks]

b) Explain briefly the following,

- (i) Parting sand,
- (ii) Facing sand,
- (iii) Backing sand.

[3.0 Marks]

c) What points to be considered when designing a casting?

[3.0 Marks]

d) Describe the need of investment casting and explain the investment casting process.

[2.0 Marks]

e) State the advantages and limitation of sand casting.

[2.0 Marks]

Q4. a) What is the significance of "particle size, distribution and shape" in Powder Metallurgy (PM) technique?

[3.0 Marks]

b) Explain briefly self-lubricating of bearings.

[2.0 Marks]

c) Compare the features of powder metallurgy against the following process,

- (i) Casting,
- (ii) Extrusion,
- (iii) Forging,
- (iv) Machining.

[4.0 Marks]

d) What is sintering and what are the objectives of sintering in powder metallurgy.

[3.0 Marks]

- Q5. a) Explain the principle of "resistance welding". [2.0 Marks]
- b) What measures can be taken to reduce the resistance between the electrode and the work-pieces? [2.0 Marks]
- c) Describe the process of Sub-Merged Arc Welding (SMAW) with the aid of a clear sketch. [3.0 Marks]
- d) Describe briefly, the principle and the mechanism of rolling. [3.0 Marks]
- e) What will happen to a metal when it is rolled? [2.0 Marks]