

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

MECHANICAL ENGINEERING - 2ND YEAR DEGREE

SECOND SEMESTER EXAMINATIONS - 2024

ME 322 - METAL CUTTING AND MACHINE TOOLS

WEDNESDAY, 23rd OCTOBER 2024 - 08.20 AM

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read the paper. You **must not** begin writing during this time.
2. Answer **All the** questions.
3. Use **only ink**. Do not use pencil for writing except for drawings and sketches.
4. Start each question on a new page and show all your calculations in the answer book provided. No other written material will be accepted.
5. Write your **NAME** and **NUMBER** clearly on the front page. **Do it now**.
6. Calculators are permitted in the examination room. Notes and textbooks are not allowed.

MARKING SCHEME:

Question Number	SLO	Marks	%
Question Number 1	SLO2	05	12.5%
Question Number 2	SLO3	05	12.5%
Question Number 3	SLO3	05	12.5%
Question Number 4	SLO4	05	12.5%
Question Number 5	SLO4	05	12.5%
Question Number 6	SLO3	03	7.5%
Question Number 7	SLO5	06	15%
Question Number 8	SLO5	06	15%

Question Number 1 (5 marks)

With neat sketches explain what do you mean by positive and negative rake angles. State the conditions under which positive and negative rake angles are recommended.

Question Number 2 (5 marks)

Calculate the time required to mill a slot of 350 mm × 30 mm in a work piece of 350 mm length with a side and face milling cutter of 120 mm diameter, 30 mm wide and having 20 teeth. The depth of cut is 6 mm, the feed per tooth is 0.1 mm and cutting speed is 34 m/min. Assume over travel distance of 5 mm.

Question Number 3 (5 marks)

A cast-iron surface 300 mm long and 180 mm wide is to be machined on a shaper with cutting-to-return ratio of 3 : 2. Cutting speed, feed and clearance are 24.6 m/min, 2 mm/double stroke and 30 mm respectively. The available ram strokes on the shaper are : 28, 40, 60 and 90 strokes/min. If the depth of cut is 3.5 mm, determine :

- (i) Time required to machine the surface.
- (ii) Material removal rate.

Question Number 4 (5 marks)

It is required to divide the periphery of a job into 28 equal divisions. Find the indexing arrangement. The following Index-plates are available.

Index-plate hole circles

Plate 1 15-16-17-18-19-20

Plate 2 21-23-27-29-31-33

Plate 3 37-39-41-43-47-49

Question Number 5 (5 marks)

Differentiate between Simple indexing and Differential indexing methods.

Question Number 6 (3 marks)

Discuss various problems associated with grinding

Question Number 7 (6 marks)

Sketch and Explain the Process of Electro Chemical Machining.

Question Number 8 (6 marks)

In an EDM process using RC relaxation circuit, a 12 mm diameter, through hole is made in a steel plate of 50 mm thickness using a graphite tool and kerosene as dielectric. Assume discharge time to be negligible. Machining is carried out under the following conditions.

Resistance = 40 ohms

Capacitance = 20 μ F

Supply voltage = 220 V

Discharge voltage = 110 V

Find Average power input (in kW) and Cycle Time.