EXAM TITLE: Mechanical Technology

OPTION: General Mechanics (GME)

DURATION: 3 hours

INSTRUCTIONS:

The paper is composed of three (3) main Sections:

Section I: Fourteen (14) questions, all Compulsory. 55 marks

Section II: Five (5) questions, Choose any Three (3). 30 marks

Section III: Three (3) questions, Choose any One (1). 15 marks
SECTION I. FOURTEEN (14) COMPULSORY QUESTIONS.

01. Mention the reasons why saw setting is essential for a hacksaw blade. 3marks

02. Define the tapping operation and name the cutting tools used. 4marks

03. Draw a cutting tool with zero, positive and negative rake. 3marks

04. What will be the r.p.m of a 40mm diameter drill when drilling on a mild steel plate?
   The recommended cutting speed is 27m/min. 3marks

05. List the properties of a cutting fluid. 6marks

06. Find the gears for cutting screw having 12mm pitch on a lathe having lead screw of 4threads/inch. 3marks

07. With the neat sketches, represent the process of:
   a. Back extrusion   b. Bending 4marks

08. List the properties of Aluminium. 3marks

09. Define the following properties of metals:
   a. Ductility   b. Conductivity   c. Fusibility 6marks

10. Make the classification of cold-chisels and give their applications. 4marks

11. Define the Probable causes Rough hole and give the appropriate Remedies.4marks

12. Give any five (5) principal cutting tools materials. 5marks

13. With the help of the respective sketches, identify the rake and clearance on:
   a) Lulling cutter
   b) Lather tool. 4marks

14. What are three (3) main purposes of marking out on a work piece? 3marks
SECTION II. CHOOSE AND ANSWER ANY THREE (3) QUESTIONS.

15. a. What do you understand by lathe accessories?
    b. List any eight (8) lathe accessories

16. Calculate all machining particulars for milling a helical gear having 22 teeth, helix angle 28°, module 2, leadscrew of machine = 5mm;
    a) Index plates with circles of holes are:
       - Plate N°1- 15, 16, 17, 18, 19, 20;
       - Plate N°2- 21, 23, 27, 29, 31, 33;
       - Plate N°3- 37, 39, 41, 43, 47, 49 holes;
    b) Available gears for machine: 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 120, 150;

<table>
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<tr>
<th>Number of cutter</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of teeth</td>
<td>12-13</td>
<td>14-16</td>
<td>17-20</td>
<td>21-25</td>
<td>26-34</td>
<td>35-54</td>
<td>55-134</td>
<td>135-00</td>
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17. A steel bar of 90mm diameter is to be turned to 80mm diameter in one cut on a lathe using a cemented carbide tool. If the axial feed rate is to be 0.25mm per revolution, calculate:
   (a) The power required
   (b) The cutting force at the mean diameter
   (c) The time to machine an 80mm length of the bar.
   Assume: the cutting speed of 150m/min and Specific power of 55x10⁻³W/mm³/min

18. a) At what speed a 20mm drill will run for cutting steel at 36m/min cutting speed?
    b) Give all the factors upon which depends a cutting speed of a drill.

19. Draw and discuss the types of file sections. Give the application of each one
SECTION III. CHOOSE AND ANSWER ANY ONE (1) QUESTION.

20. Explain the effect of the following elements on the properties of steel when alloyed.

   (a) Nickel
   (b) Chromium
   (c) Cobalt

   15 marks

21. A lathe has four steps, the diameter of each being 90mm, 130mm, 170mm, 210mm. The countershaft pulley revolves at 1200rpm. The gears A, B, C and D have 16, 48, 16, and 48 teeth respectively;

   a. Find the various speeds of the spindle / “spindle”

   b. Name the elements 1, 2, 3 and 4 of the figure

   15 marks

22. Discuss the specifications of a Lathe machine.

   15 marks