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LEAVING CERTIFICATE EXAMINATION, 2001

TECHNICAL DRAWING – HIGHER LEVEL
PAPER II(A) – ENGINEERING APPLICATIONS

Friday, 15 June, Afternoon 2.00 – 5.00 p.m.

200 Marks

INSTRUCTIONS

(a) Answer four questions.
(b) All questions carry equal marks.
(c) Drawings and sketches should be in pencil unless otherwise stated.
(d) Where dimensions are omitted they may be estimated.
(e) Credit will be given for neat orderly presentation of work.
(f) Candidates should work on one side of the paper only.
(g) The Examination Number should be written on each drawing sheet used.
(h) All dimensions are in millimetres.

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OVER →

1. Details of a Non-Return Valve are given in Fig. 1 with the parts list tabulated below.

PART	NAME	REQUIRED
1	SEAL	1
2	BODY	1
3	VALVE SEAT	1
4	COVER	1
5	VALVE	1

(a) Draw a full size sectional elevation of the assembly corresponding to the given sectional elevation of the body (part 2). Show the valve in the closed position.

(b) Insert item reference numbers to identify the parts and add the title NON-RETURN VALVE.

(c) **(i)** The body (part 2) is to be produced as a casting. Suggest a material suitable for this purpose.

(ii) With the aid of an arrow placed at the inlet port, show the direction of flow through the valve.

(iii) Measure and dimension on the drawing the lift of the valve (part 5).

2. **(a)** Draw the profile and displacement diagram for a cam rotating uniformly at 10 revolutions per minute, in an anti-clockwise direction, and imparting, in one revolution, the following motion to an in-line knife edge follower:

Rise 36 mm with uniform acceleration and retardation in 1.5 seconds.

Dwell for 1 second.

Fall 36 mm with simple harmonic motion in 3 seconds.

Dwell for the remainder of the revolution.

The minimum distance between the central axis and the cam edge is 35 mm.

(b) In the pin jointed mechanism shown in Fig. 2 the cranks AB and CD rotate with the same constant angular velocity but in opposite directions. The piston F is constrained to move vertically and the cranks are in their initial starting position.

(i) Draw the mechanism and plot the locus of point E during one revolution of the cranks.

(ii) Measure and dimension on your drawing the length of stroke of piston F.

AB = CD = 30
BE = DE = EF = 105

FIG. 2
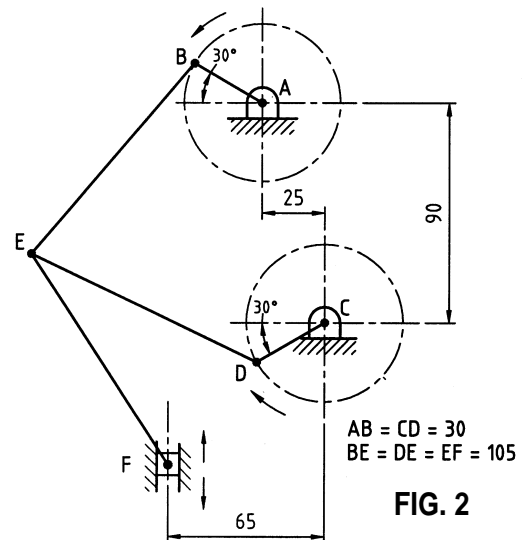
3. Drawings of a Control Bracket, in first angle projection, are shown in Fig. 3.

(a) Draw the following views of the bracket in either first or third angle projection:

    (i) The given elevation which contains the cutting planes;

    (ii) A sectional side elevation on A-A;

    (iii) A sectional plan on B-B.

(b) Insert the following on the drawing:

    (i) Four leading dimensions.

    (ii) The appropriate ISO projection symbol.

    (iii) A symbol to indicate that surface Z is to be machined by grinding; surface texture N5.

    (iv) Limits of size on the diameter 90 H7 bore. Table of limits and fits is provided below.

    (v) Title: CONTROL BRACKET.

NOMINAL SIZES		TOLERANCE		TOLERANCE	
OVER	TO	H7	h6	H7	k6
mm	mm	0.001 mm	0.001 mm	0.001 mm	0.001 mm
80	120	+35	−22	+35	+25
		0	0	0	+3

4. Fig. 4 shows the elevation and plan of a transition piece for part of a ventilation system, which is to be fabricated from thin sheetmetal and welded along the joint SS.

(a) Draw the given views and produce a one piece surface development of the transition piece with a joint along SS.

(b) Make large sectional freehand sketches of the following:

    (i) A double grooved joint;

    (ii) A single lap rivetted joint and name the type of rivet used;

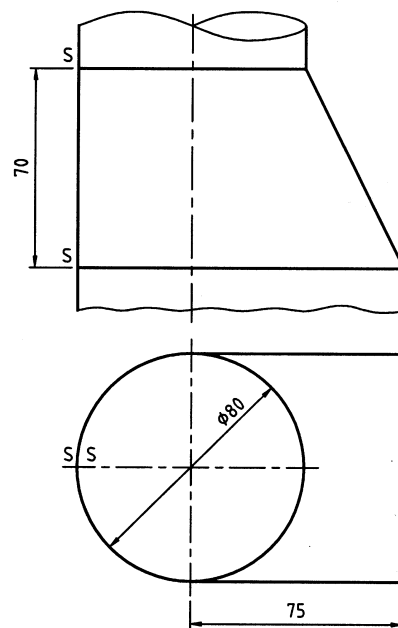   **(iii)** A double hemmed edge.

70

S

S

Ø80

S S

75

FIG. 4

5. A sectional view of a speed reduction gearbox is shown in Fig. 5.

(a) The following twelve parts are identified with item reference numbers 1 to 12.

Ball bearing, Thrust ball bearing, Double row angular contact ball bearing, Double row self aligning ball bearing, Internal circlip, External circlip, Hex head set screw, Socket head set screw, Grub screw, Oil seal, Bevel gear wheel, Splined shaft.

Draw a parts list, which tabulates the item number and name, for each of these parts.

(b) Make the following drawings, scale 1 : 1, of the spur gear, part 13.

(i) A sectional elevation similar to that given;

(ii) A front elevation, in the direction of arrow Y, using standard conventional representation.

The gear has 25 teeth of involute form, module 4, 20° pressure angle, face width 24 mm and is keyed to the input shaft, diameter 20 mm, using a 5 mm × 5 mm square section key.

Tabulate on the sheet the following values for the gear, the addendum, dedendum, pitch circle diameter, circular pitch, tooth thickness, and base circle diameter.

(c) The pair of meshing bevel gears, shown in Fig. 5 provides a gear ratio of 3 : 1. The shafts are set at an angle of 90° to each other. The pinion, which is the smaller gear, has a pitch circle diameter of 48 mm.

(i) Draw, full size, the <u>outline</u> of the pitch cones for the gears in mesh.

(ii) Dimension on the cones the pitch circle diameter and the pitch cone angle.

6. **Answer SECTION A or SECTION B but not both.**

<u>SECTION A</u>

(a) Fig. 6(a) shows two views of a valve rocker.

Draw full size an isometric view of the rocker with the theoretical corner marked X as the lowest point. Hidden detail is not required.

(b) Using <u>four</u> separate freehand-annotated line diagrams, explain the operation of the four-stroke compression engine. Show clearly the actions of the piston and the intake and exhaust valves during each of the four piston strokes.

OVER →

SECTION B

(a) Fig. 6(b) shows the main window of a CAD system, with 10 parts identified with item reference numbers 1 to 10. Match each of the numbered items with the correct term from the following selection:

- Pan and Zoom Tools,
- Minimise window,
- Scroll box,
- Screen menu,
- Crosshairs/Pickbox,
- Command window,
- Menu bar,
- Drawing area,
- Co-ordinate display,
- World Co-ordinate system icon.

(b) Draw, full size, the object that would be displayed on a CAD system when the following commands are executed. All points (X, Y) are specified using absolute co-ordinates. The origin (0,0) is located at the lower left corner of the display.

- The sheet size is set. Lower left corner (0,0) and (148,210) upper right corner.
- Lines are drawn from point A (70,60), to point B (50,60), to point C (20,100), to point D (20,120).
- The three lines drawn are selected and mirrored about a mirror line. The first point on the mirror line is at (70,60) and the second is at (70,120). The old object is not deleted.
- A 3-point arc is drawn. Start point (20,120), second point (70,170) and end point (120,120).
- A diameter 30 mm circle is drawn, centre point (70,120).
- The text 'TEMPLATE' is inserted. The text is centre justified about point (70,30), text height 5 mm, text rotation angle 0°.

(c) A company is considering the purchase of a single computer system to use for CAD. It has a large library of existing paper drawings, which it would like to transfer to the CAD system and publish on the Internet.

(i) Specify the amount of RAM, speed of CPU/Processor, size of hard disk and type of monitor that would be required for a typical CAD system.

(ii) State which item of peripheral equipment would be required to convert the paper-based drawings to CAD files.

(iii) Name the additional piece of computer hardware that must be purchased in order to access the Internet using conventional telephone lines and specify a typical operating speed for this device.

(d) With the aid of sketches show the resulting combinations when the following solid modelling operations are applied to the <u>two</u> solids shown in Fig. 6(b)1:

(i) UNION   **(ii)** SUBTRACTION   **(iii)** INTERSECTION

(e) List the commands you would use, in the sequence that you would use them, to convert the drawing shown in Fig. 6(b)2 into the drawing shown in Fig. 6(b)3.

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