INSTITUTION OF ENGINEERS, SRI L[illegible]A
PART I EXAMINATION – MARCH 2008

102 – PRESENTATION OF ENGINEERING INFORMATION

Time allowed: Three Hours **Date: 2 April 2008**

Before start answering the question paper, read the instructions given below and adhere to these instructions.

- This question paper has three sections, SECETION A, SECTION B and SECTION C. Answer only **five (05)** questions selecting at **least one (01)** question from each section.
- All questions carry equal marks.
- The candidate should answer the question/s in each section on a different answer book and the front page of the answer book should have the section identification.
- Candidate should make **neat, clear, free hand sketches** when answering questions in the Section 1. Where applicable, the candidates should clearly show the details of **geometrical constructions and methods of projections** such drawings should be drawn to scales. In case of mechanical systems or products show **the details of principals of operations of any mechanisms, and their associated components and assemblies.** Assume any missing dimensions.
- Start answering each question on a new page and write the relevant question No. appropriately on the answer book.
- **It is extremely important** that you write the question No. to which you answer appropriately in the cage appearing on the cover page
- Strike out any rough work and contents that you do not wish to draw the attention of the examiner.
- **Marks will be deducted if the above instructions are not adhered to.**

SECTION A

Question 1

(i) Figure Q1(i) shows an isometric view of a steel bracket, which supports t shafts. Produce the following views in the third angle projection.

(a) Front Elevation looking in the direction of arrow A.

(b) Sectional End Elevation projected to the right of (a), with the bracket being sectioned by a vertical plane that contains axes of both 25 mm diameter and 32 mm diameter bores.

(c) Inward plan

(ii) Figure Q 1(ii) shows projections ab and a^1b^1 of a line AB on horizontal and vertical planes respectively. With a simple geometrical construction, determine the following:

(a) True length of AB

(b) Inclination of AB to the horizontal plane

(c) Inclination of AB to the vertical plane

(d) Distance of horizontal trace from XY

(e) Distance of vertical trace from XY

Question 2

(i) A right regular hexagonal pyramid, 80 mm of vertical height and 35 mm side of hexagon, is placed on a horizontal plane and its elevation and plan are shown in Figure Q2 (i). The edge 1-6 is perpendicular to the trace of the horizontal plane (X-Y). The plane X_1-Y_1 is inclined at an angle of 47^0 to the face containing the edge 1-6.

Sketch the given plan and elevations.

Draw the projection of the pyramid on the plane X_1-Y_1.

(ii) The circle with 500 mm radius given in Figure Q2 (ii) shows the [illegible] of a uniform cross section of a trunk of a tree. A rope, of which [illegible] attached to the trunk, is wound around the tree in anticlockwise direction the other end is tied to the neck of a bull (not shown in the figure). At the given configuration, the point P on the rope just touches the circle on the diametrical line. The bull, while keeping the rope taut and tangential to the circle always walks around the tree in clockwise direction, so that the rope unwinds. Name the locus and draw the locus of the point P.

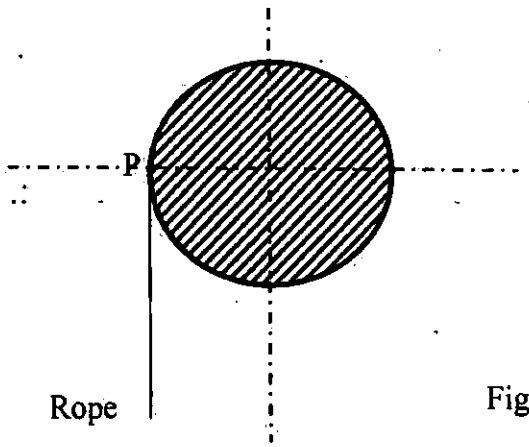

Figure Q2(ii)

Question 3

(i) Make sketches of any three of the following items, so that the selected views and method of projections in each case best demonstrate the working mechanism, components and special features, if any, associated with the relevant item.

(a) Garden tap

(b) Bench vice

(c) Pipe wrench

(d) Domestic water pump

(e) Hand operated fly press

(ii) Figure Q 3(ii) shows two views (Front Elevation and Plan) of a Bevel Gear Bearing bracket. Draw the isometric view of it taking the near point described by the two arrows. You may use a graph paper to answer this question.

SECTION B

Question 4

(i) Realise using minimum number of 2-input NAND gates,

(a) a 2-input AND gate and

(b) a 2-input XOR gate.

(ii) A logical function F (A,B,C,D) with *don't care* terms is given as

$$F = \sum 1,7,15 + \text{dc terms } (3, 11, 14)$$

(a) Construct the truth table for F. Find an expression for the inverse of F using the truth table.

(b) Draw the Karnaugh map for F. Find a simplified expression for F using the Karnaugh map.

(iii) Construct the truth table of the function

$$F = xy + x\bar{y} + \bar{y}z$$

Question 5

(i) (a) What is a compiler? Describe the functions of a compiler.

(b) Describe the functions of an interpreter.

(c) Describe the problems faced by a compiler when handling a programme written in a high-level computer language.

(d) Draw a simple flow chart to describe an algorithm to receive and sort five numbers in descending order.

(ii) A mathematical model is given by

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 10y = 10x$$

The model is to be simulated on an analog computer.
Draw the analog computer block diagram simulation making appropriate assumptions.

Question 6

A building of four floors and of about 4000 sq ft of total floor area is electrically wired but it is noted that no provisions had been made in the walls for wiring except in the slabs. An incomplete network diagram to help to manage the project had been prepared with each activity joining one node to another node and with each node given a number. Three estimates in weeks identified as a, b and c have been made for the time duration of each activity and the information is given in the following table.

No.	Nodes	Description	a	b	c
1	1 to 2	plan	1	2	3
2	2 to 3	purchase material	1	2	3
3	2 to 4	prepare walls	2	3	4
4	4 to 5	lay wires	2	4	6
5	4 to 6	Install plugs, switches,etc.	2	4	6
6	6 to 5	Install main switch, etc	1	1	1
7	5 to 7	Test circuit	1	1	1

Note: Null activities are not shown in the above table.

Draw the network diagram for the project, identify the critical path and determine the total duration (D) of the project.

Find also the probabilities that the project can be completed in
(a) D – 1, (b) D + 1 weeks.

(10)

SECTION C

Question 7

In a country, number N of computer personnel working in different years (t) given as follows

Year	1980	1985	1990	1995	2000
Number of Computer personnel	200	500	1000	2000	20,000

If N is such that dN/dt is proportional to N, show that a linear model will not be suitable to fit a graph for N in terms of t.

Also show that $N = N_0 e^{\alpha t}$, with N_0 and α are constants will be a suitable curve.

By taking a suitable time measurement t, find N_0 and α.

Write a short computer programme to forecast N for every year from 2005 to 2010 based on the above derived formula.

Question 8

A company is producing aerated water bottles through three plants A, B and C. It is found that these plants produce 40%, 30% and 30%, respectively of the total items and that 2%, 4% and 3% respectively of the items produced by A, B and C are defective. If an item produced by the company is picked up at random what is the probability that it is defective?

If 5 items produced by the company is taken what are the probabilities that (a) no item will be defective, (b) 1 will be defective, and (c) more than 1 will be defective.

If a customer had reported of a defective item produced by the company describe how the management can find which plant had most probably produced the item if there are no indications in the bottle or in the label giving the required information.

Question 9

Figures of annual tea production in M kgs for a 50 year period are given in the following frequency distribution table:-

Range (M. kgs)			Frequency
130 to less than 160			6
160	do	190	10
190	do	220	21
220	do	250	12
250	do	280	1

Determine the grouped mean and standard deviation of the annual tea production. Find also the probability for a given year that tea production will be between 200 and 210 M. kgs.

It is also observed that on average there is 1 industrial dispute in one year in this plantation sector. Find in any given year the probabilities that that there will be (a) at most 1 industrial dispute, (b) at least 1 industrial dispute.

Find also the probabilities that (c) tea production will be between 200 & 210 and there will be at most 1 industrial dispute, (d) tea production will be in the same range and there will be at least 1 industrial dispute.

[With the usual notations for X_i, i = 1,2, …, N; take $Y_i = (X_i - a)/c$, then mean and variance are given as

$$\bar{X} = c.\bar{Y} + a$$

$$s^2 = c^2.\left(\frac{\sum_{i=1}^{N} Y_i^2}{N} - \bar{Y}^2\right) \quad]$$

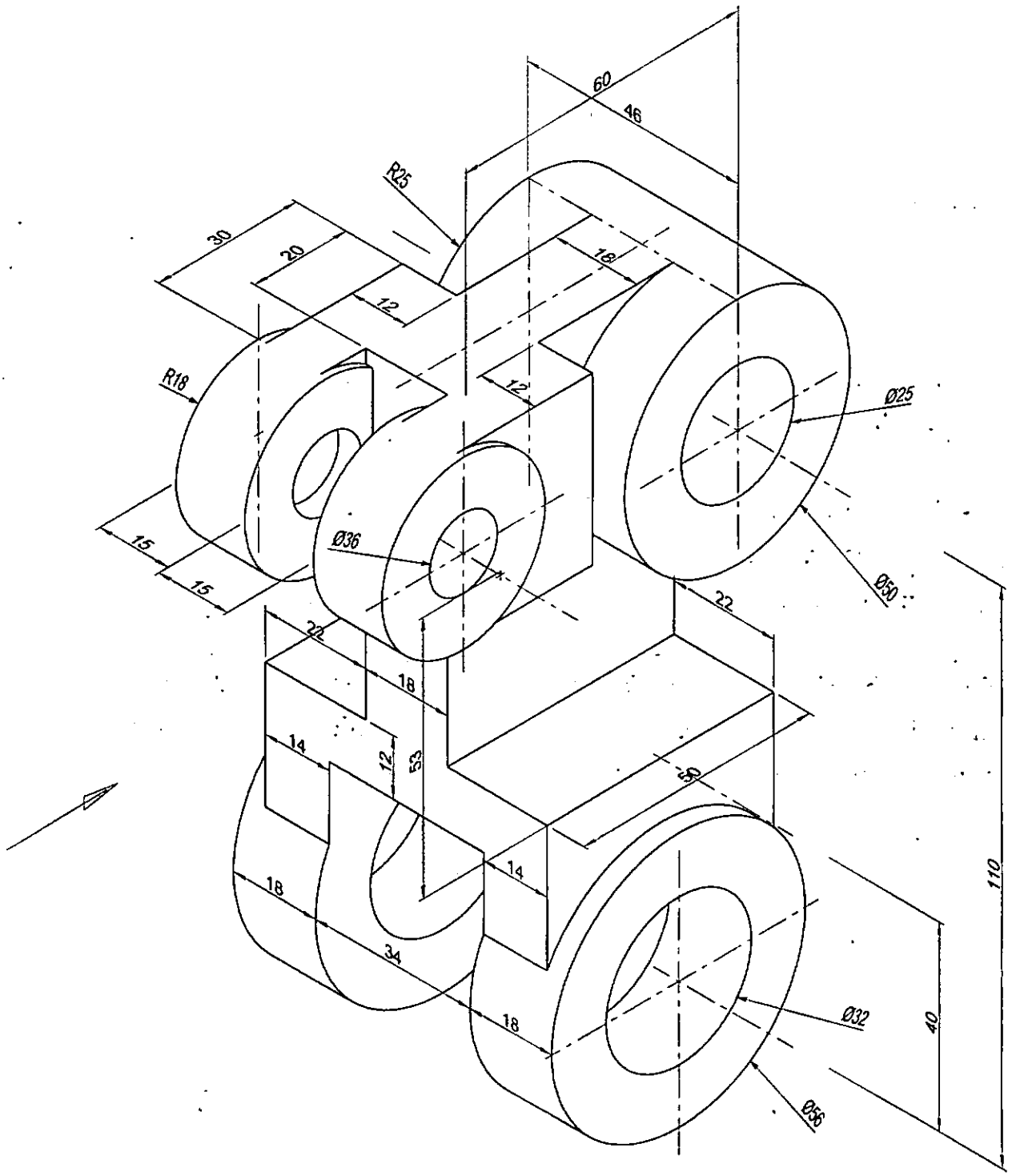

Figure Q1 (i)

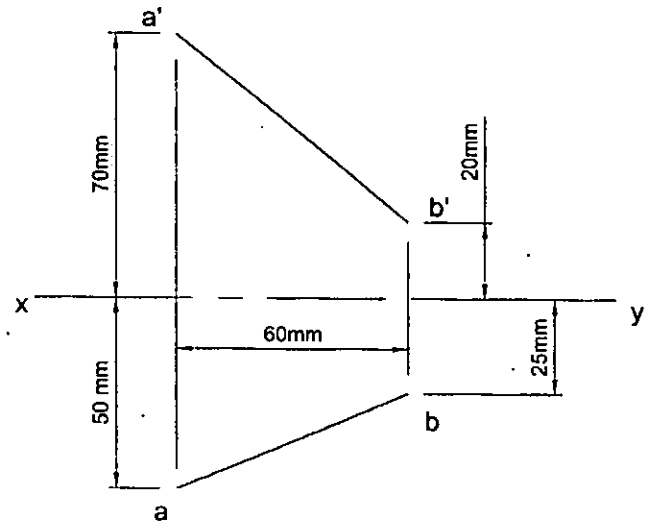

Figure Q1(ii)

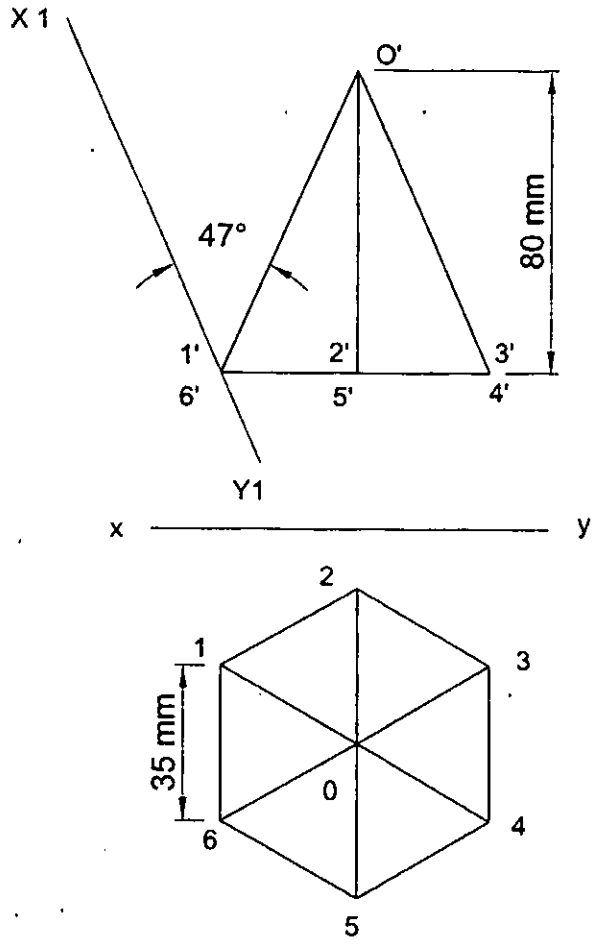

Figure Q 2(i)

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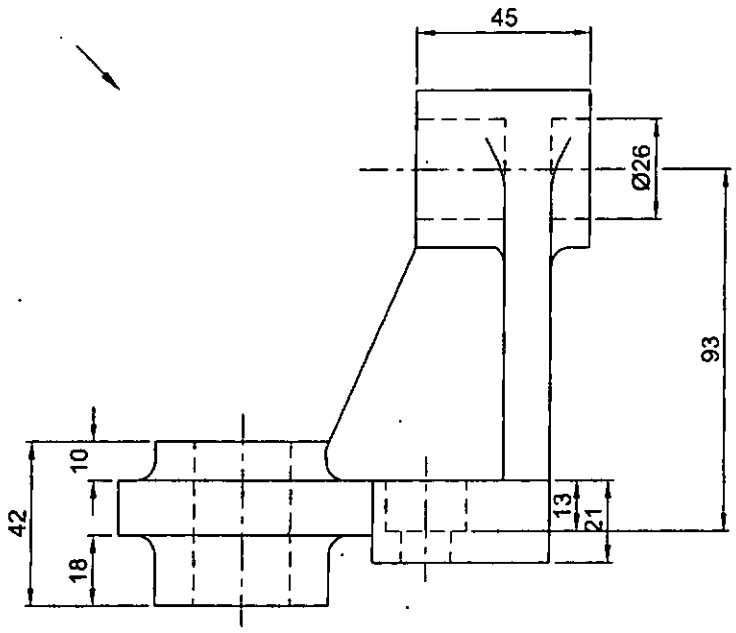
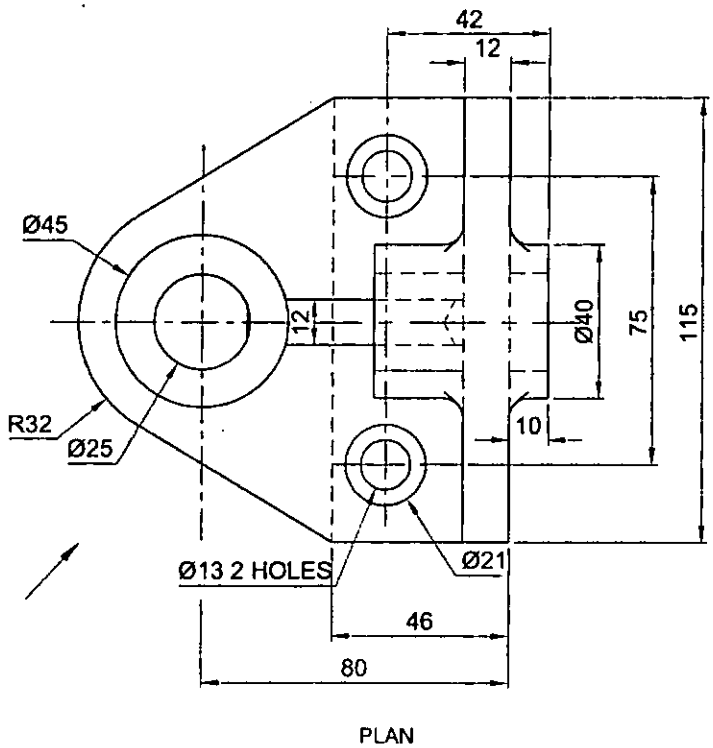


FRONT ELEVATION



PLAN

BEVEL GEAR BEARING BRACKET

Figure Q3(ii)