THE INSTITUTION OF ENGINEERS, SRI LANKA.

Part I Examination – APRIL 2006

PRESENTATION OF ENGINEERING INFORMATION

PAPER 1 – PRESENTATION OF INFORMATION

Time allowed: 3 hours

Answer **FIVE** questions selecting **at least one** from each of the three sections A, B and C.

To answer questions No. 1, 2 and 3, the candidates should make neat, free hand sketches. Where applicable, the candidate should clearly show the details of geometrical constructions and principles of operations, mechanisms etc., associated with the components/products.

Use separate answer books for each section.

SECTION A

Question 01

Fig.Q1 shows the isometric view of a solid object. Produce the following views to a scale of full size in third angle projection.

(a) Front Elevation looking in the direction of arrow "X".
(b) End Elevation projected to the left of view (a).
(c) Plan projected from view (a).

All the dimensions given in the figure are in millimeters.

Question 02

(a) Fig.Q2 (a) shows a sectional view of semi-cylinder and a rope PQ of which end Q is fixed while the other end P is free. By holding the end P and keeping the rope taut, it is wrapped around the semi-cylinder following the anti-clockwise direction.
Draw the complete locus of the end P whilst the rope is being wrapped around.

(b) A portion of a right circular cone made of thin sheet metal, is cut by a horizontal cylinder as shown Fig. Q2(b). Draw the development of the cone taking the seam at D – D.

Question 03

Make sketches of any **three** of the following items with views showing their principles of operation.

(i) Universal Joint
(iii) Cam Shaft
(iv) Petrol engine piston
(v) Helical Gear wheel
(vi) Shock absorber

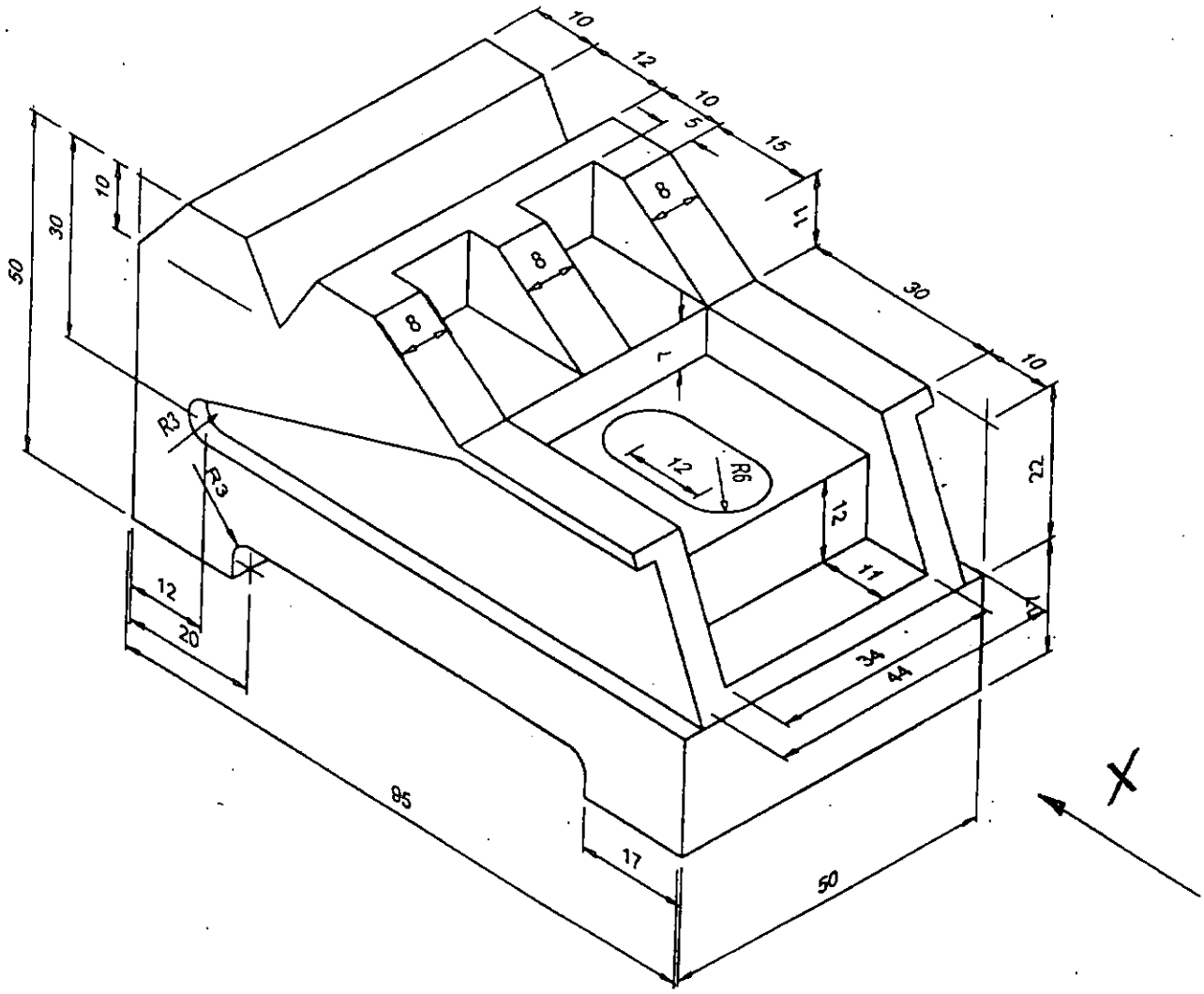

Fig. Q1

02

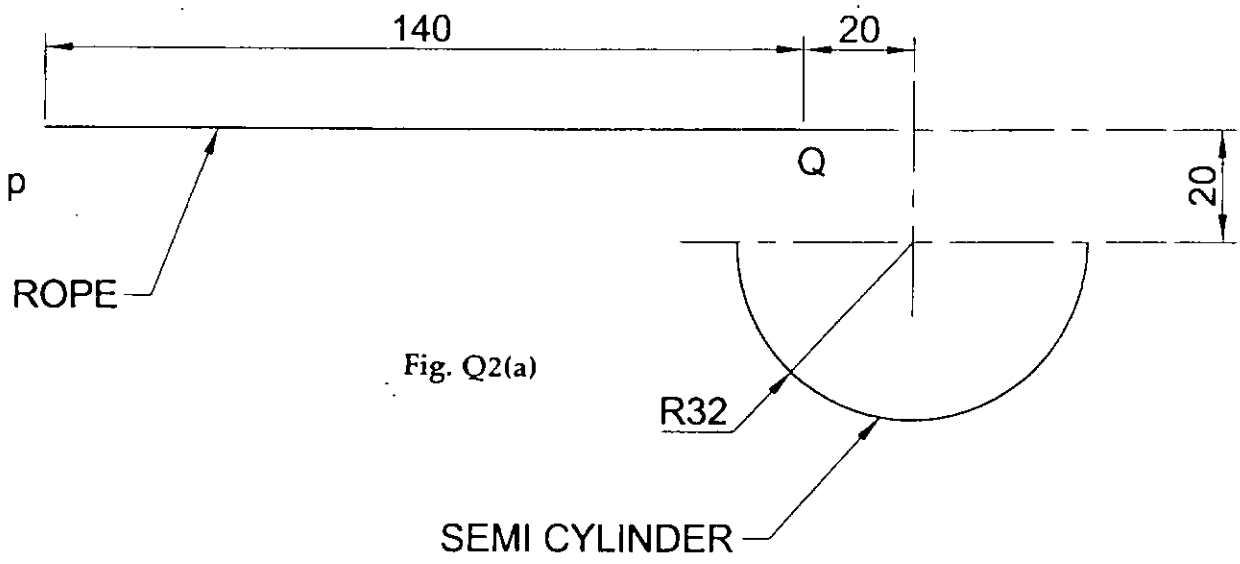

Fig. Q2(a)

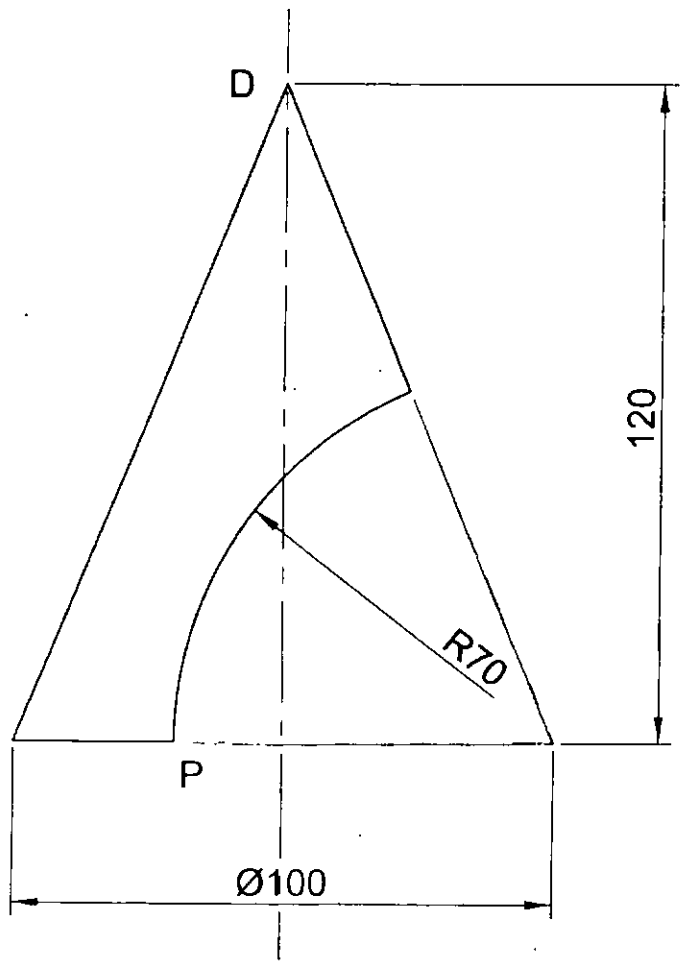

Fig. Q2(b)

SECTION B

Q4. (a) Realise, using the minimum number of 2-input NOR gates,

(i) a 2-input OR gate, and
(ii) a 2-input NAND gate.

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

$F = \Sigma\, 0, 4, 5, 6, 8, 9 + dc$ terms (2, 10, 15)

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

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

Q5. (a) Compare how compilers and interpreters handle high-level computer languages. Describe the problems faced by a compiler when handling a program written in a high-level computer language, and explain how they overcome those difficulties. Draw a simple flowchart to describe an algorithm to receive and sort five numbers in descending order.

(b) A mathematical model is given by -

$$\frac{d^2Q}{dt^2} + 0.6\frac{dQ}{dt} + 0.4Q = 0.4R$$

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

Q6 XYZ electronics are at present engaged in designing and developing a new TV camera set.
The set can be broadly divided into electronic and mechanical components. The various activities leading to the ultimate manufacture of the product are listed below.

Activity	Description	Time (Weeks)	Remarks
A	Finalise Specification	2	-------
B	Detailed Mechanical design	15	B must follow A
C	Make mechanical parts for prototype components	6	C follows B
D	Detailed electronic Components	16	D follows A
E	Make electronic Components for prototype model	6	E follows D
F	Prepare testing device for mechanical parts	2	F follows B
G	Prepare testing device for electronic parts	2	G follows D
H	Complete prototype model	4	H requires completion both C and E
I	Test Electronic part in the prototype model	2	I requires completion of G and H
J	Test Mechanical part in the prototype model	4	J requires completion of F and H
K	Final approval of prototype model	1	K requires completion of both I and J
L	Complete fixtures for manufacture	10	L requires completion of K
M	Obtain materials for production	20	M requires completion of K
N	Start manufacture	2	N requires completion of L and M

05

(a) **Draw a network** to represent the logical sequence of activities and determine how long it will take the new product to be manufactured.

(b) Identify the **critical path** for this project.

(State any assumptions you require.)

SECTION C

Q7 (a) Assume that characteristics R and S are independent and the approximately normally distributed with parameters.

$\mu_R = 29.6 \quad \sigma_R = 4.8; \quad \mu_S = 15.9 \quad \sigma_S = 4.1$

Find the probability that an individual sample at random will have a reading of

(i) 20 to 32 for characteristic R

(ii) Less than 20 for characteristic S

(iii) Less than 20 for **each characteristic**

(b) Two dice are thrown 100 times. Find the probability getting exactly 3 double sixes.
You may apply the Possion distribution as an approximation to the Binomial distribution.

Q8 The table below shows the size of 100 steel items.

Size in mm	Frequency
30 – 33	2
33 – 36	4
36 – 39	26
39 – 42	47
42 – 45	15
45 - 48	6

(a) Draw a histogram and a cumulative frequency graph for this data.

(b) Find median, mode, mean and standard deviation for the distribution.

(c) Discuss the skewness of this distribution.

Q9 An engineering firm produces steel pipes in three plants(A, B and C) with daily production volumes of 500, 1000 and 2000 units respectively. According to past experience, it is known that the fraction of defective output produced by the three plants are 0.005, 0.008 and 0.010 respectively.
A pipe is selected from the total production of a day. Draw a tree diagram to show this information.

Find,

(a) the probability that this pipe is **not defective ?**

(b) If the selected pipe is **defective** , the probability that it was produced from the plant A ?

(c) 800 and 1500 pipes are selected from plants C and B respectively. . Find the probability that from this stock only **3 pipes are defective.**