Marking Scheme: Questions have 3 subparts each. Subparts (a) and (b) carry 3 marks each and subpart (c) carries 4 marks. All questions are compulsory.

Question 1:
 a. Solve for x:
    $2\tan^{-1}(\cos x) = \tan^{-1}(2 \operatorname{cosec} x)$
 b. Differentiate $\sin^2 x$ w.r.t. $e^{\cos x}$.
 c. The cost of 4 kg onion, 3 kg wheat and 2 kg rice is Rs 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is Rs 90. The cost of 6 kg onion 2 kg wheat and 3 kg rice is Rs 70. Find cost of each item per kg by matrix method.

Question 2:
 a. Form the differential equation of the family of circles in the second quadrant and touching the coordinate axes.
 b. Write down a unit vector in XY-plane, making an angle of 30° with the positive direction of x-axis.
 c. Find the absolute maximum and minimum values of the function f given by
    $f(x) = \cos^2 x + \sin x$, $x \in [0, \pi]$

Question 3:
 a. Find the coordinates of the point where the line through (5, 1, 6) and (3, 4, 1) crosses the ZX-plane.
 b. Find the particular solution of the differential equation
    $(1 + e^{2x})dy + (1 + y^2) e^x dx = 0$, given that y = 1 when x = 0.
 c. Suppose that 5% of men and 0.25% of women have grey hair. A grey-haired person is selected at random. What is the probability of this person being male? Assume that there are equal number of males and females.

Question 4:
 a. Find the value of:
    $\int_1^4 [|x - 1| + |x - 2| + |x - 3|]\,dx$
 b. If the coordinates of the points A, B, C, D be (1, 2, 3), (4, 5, 7), (− 4, 3, − 6) and (2, 9, 2) respectively, then find the angle between the lines AB and CD.
 c. Using the method of integration find the area of the triangle ABC, coordinates of whose vertices are A(2, 0), B (4, 5) and C (6, 3).