**Final Exam, M-106, TM II, (2014-15), Department of Mathematics, King Saud University**

1. **[3+2 Marks]**

   1.1) Use logarithmic differentiation to find $\frac{dy(x)}{dx}$ where $y(x) = \frac{(x^2+3)^{2x}}{x+1}$.

   1.2) Evaluate the integral $\int x\sqrt[3]{7-6x^2}\,dx$.

2. **[3+3 Marks]**

   2.1) Let $A$ be the area under the graph of $f(x) = x + 1, \text{on } [1,2]$. Find the area $A$ by taking limit of Riemann Sum.

   2.2) **Evaluate** $\int cos^3(x)\, sin^4(x)\, dx$.

3. **[3+3+3 Marks]**

   3.1) Evaluate the integral $\int \frac{4x+5}{x^2+2x+10}dx$.

   3.2) Sketch the region bounded by the graphs of the equations: $y = x^2 + 2;\ x = 2y - 2, x = 0, x = 1$. And find its area.

   3.3) Evaluate the integral $\int \frac{(e^x+1)^2}{e^x}dx$.

4. **[2.5+2.5 Marks]**

   4.1) Evaluate the integral $\int \frac{1}{x\, logx}dx$

   4.2) Evaluate the integral $\int \frac{3sinx}{1+2cos(x)}dx$

5. **[3+3 Marks]**

   5.1) Sketch the region $R$ bounded by the graphs of the equations: $y = \frac{1}{x}, x = 1,\ x = 3, y = 0$, and find the volume of the solid generated if $R$ is revolved about $y$ −axis.

   5.2) Find the arc length of the graph of the equation $y = 5 - \sqrt{x^3}$ from $A(1,4)$ to $(4,-3)$.

6. **[5+4 Marks]**

   6.1) Sketch and find the area of the region that is outside the graph of the equation $r = 1 - \sin(\theta)$ and inside the graph of the equation $r = \sin(\theta)$.

   6.2) Sketch and find the area of the surface generated by revolving the graph of the equation $r = 2 + 2\cos(\theta)$ about the polar axis.