PUBLIC SERVICE COMMISSION, PESHWAR

COMPETITIVE EXAMINITION FOR PROVINCIAL MANAGEMENT SERVICES, 2018

APPLIED MATHEMATICS (PAPERII)

TIME ALLOWED: Three Hours　　　　Max. Marks: 100

Instruction: Attempt two questions from Section A, one question from section B and two questions from section C

SECTION A

Q No. 1(a) Find the regular singular point and general solution of $3xy'' + y' - y = 0$ (10)

(b) Find two linearly independent power series solution about the ordinary point $x = 0$

$$y'' - (x+1)y' - y = 0$$ (10)

Q No. 2a] Solve the heat equation

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$$

$$\frac{\partial u(0,t)}{\partial x} = 0\ , \frac{\partial u(L,t)}{\partial x} = 0\ \ , u(x,0) = \begin{cases} 0 & x < \frac{L}{2} \\ 1 & x > \frac{L}{2} \end{cases}$$ (10)

(b) Find the solution of $c\frac{\partial^2 u}{\partial t^2} = a\frac{\partial^2 u}{\partial x^2} - b\frac{\partial u}{\partial t}$

Subject to $u(0,t) = 0$, $u(L,t) = 0$ $u(x,0) = f(x)$, $\frac{\partial u(x,0)}{\partial t} = g(x)$ (10)

Q No. 3a] Find the solution of Laplace equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$$

the top is $z = H$ and bottom is $z = 0$ and $\frac{\partial u(x,y,0)}{\partial z} = 0\ , u(x,y,H) = f(x,y)$

$u = 0$ is the lateral side and region is rectangular box $0 < x < L\ , 0 < y < w\ , 0 < z < w$. (10)

(b) Calculate the total energy in the rod if two ends of a uniform rod of length L are insulated (10) there is a constant source of thermal energy $Q_0 \neq 0$ and temperature is initially $u(x,0) = f(x)$.

Section B

Q No. 1(a) Determine the metric tensor in cylindrical coordinates. (10)

(b) Show that g^{jk} is a symmetric contravariant tensor of rank two. (10)

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