temperature. Determine the temperature at a point of plate as t increases. 4

7. (a) Find the solution of equation when heat flow in circular plate. 4

(b) Find out the equation of motion for the vibrating string. 4

8. (a) Determine the possible modes of oscillations of hanging chain. 4

(b) Find out the solution of Laplace equation in Cartesian coordinates. 4

Roll No. ....

41271

B. Sc. Hons. Physics 4th Semester Examination – May, 2019

MATHEMATICAL PHYSICS IV

Paper : PHY-401

Time : Three hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting at least ***one*** question from each Unit. Uses of Scientific (non-programmable) calculator is allowed.

UNIT – I

1. (a) Derive the relation between Beta and Gamma function. Also define these functions. 2

(b) Evaluate $\Gamma\left(\frac{1}{n}\right)\Gamma\left(\frac{2}{n}\right)\,.........\,\Gamma\left(\frac{n-1}{n}\right)$, where n is a positive integer. 3

(c) Prove that $\Gamma(m)\,\Gamma\left(m+\frac{1}{2}\right) = \frac{\sqrt{\pi}}{2^{2m-1}}\,\Gamma(2m)$,

where m is positive. Also show that

$\beta(m, m) = 2^{1-2m}\,\beta\left(m, \frac{1}{2}\right)$. 3

2. (a) State and prove the generating function for Bessel's polynomials. 3

(b) State and prove the Rodrigue's formula for Legendre's polynomials. 2

(c) Prove the following recurrence relations : 3

(i) $(2n+1)\,Pn(x) = P'_{n+1}(x) - P'_{n-1}(x)$

(ii) $2J'_n(x) = J_{n-1}(x) - J_{n+1}(x)$

3. (a) State and prove the orthonormality property of Hermite polynomials. 4

(b) Prove that : 2

$$\frac{1-t^2}{(1-2xt+t^2)^{3/2}} = \sum_{n=0}^{\infty} (2n+1)\,t^n\,P_n(x)$$

(c) Show that $J_{-n}(x) = (-1)^n J_n(x)$, where n is any integer. 2

4. (a) State and prove the orthonormality of Lagu polynomials.

(b) State and prove the Generating function Hermite polynomials.

(c) Prove that :

(i) $M_0(-x) = (-1)^n H_n(x)$

(ii) $L'_n(x) - n\,L'_{n-1}(x) + nL_{n-1}(x) = 0$

UNIT – II

5. (a) Find the displacement of the vibrating string Length 'a' whose ends are fixed. Given $f(x)$ initial displacement and $g(x)$ is the initial velo of string.

(b) Find the solution of one-dimensional h equation.

6. (a) Solve the wave equation for transverse vibrati of a rectangular membrane with periphery fix Find the allowed angular frequencies.

(b) A thin rectangular plate whose surface impervious to heat flow has t = 0 an arbitr distribution of temperature $f(x, y)$. Its four edg $x = 0$, $x = a$, $y = 0$, $y = b$ are kept at ze