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Peristaltic Flow with Nanofluid under Effects of Heat Source, and Inclined Magnetic Field in the Tapered Asymmetric Channel through a Porous Medium

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Abstract
In this present paper , a special model was built to govern the equations of two dimensional peristaltic transport to nanofluid flow of a heat source in a tapered considered in an asymmetric channel. The equations of dimensionless temperature concentration are analytical solve under assumption slow Reynolds number and long wave length. Furthermore, the results that receive by expressing the maximum pressure rise communicates increased in case of non-Newtonian fluid when equated with Newtonian fluid. Finally, MATHEMATICA 11 program has been used to solve such system after obtaining the initial conditions. Most of the results of drawing for many are obtained via above program .

Keywords: Tapered asymmetric channel ,peristaltic flow, radiation ,tangent nanofluid .

التدفق التمعجي لمائ من النمط النانو تحت تأثير مصدر للحرارة و مجال مغناطيسي مائل في قناة متماثلة مستدقة عبر وسط مسامي

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الخلاصه
في هذا البحث , قمنا بنمذجة المعادلات المتحكمة بالانتقال التمعجي ثنائي الابعاد بما يناسب تدفق السوائل النانوية المتعرضة لمصدر حراري بشكل مستدق (مدبب) لقناة غير متماثلة .. تم حل معادلات تركيز درجة الحرارة بدون ابعاد تحليليا وفقا لافتراضات تقريب عدد رينولدز بالاضافة لطول الموجة الطويلة لغرض تبسيط المعادلات المحكمة . بالاضافة لذلك, النتائج التي تم الحصول عليها وضحت ان الحد الاقصى لارتفاع الضغط يزداد في حالة السائل غير التيوتوني عند مقارنته بالسائل النيوتوني . اخير تمت مناقشة االرسوم ونتائج الموضحة حصل عليها بواسطة برنامج Mathematica 11.

Introduction

Peristaltic flow is a format of a nanofluid transfer is a fundamental phenomenon of transport caused by biologically and industriallynumerous When expansion and contraction

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.In most cases[1]. Nanofluids are attracting acrucial role and manufacture by suspending [2-3], By the special way with respect to the transfer of heating. Pumping ofperistaltic nanofluid in particular is an essential way of flow in numerous biologically and industrially procedures.[4] Bader et al.the problems of the motion of a fluid in rotating or translating are both interesting of domains that theoretically and practically . Investigate research [5] that is to express avery smallvolumetric portionof nanoparticles,the thermic conductivity of the base fluid is improved via (10–50) %with a notable the convective heat distribution coefficient that increases.Das et al.Heat transfer studying thatAlaa et al (2021) stated"analysis an important area in connection with peristaltic motion , which has application such as sanitary fluid transport , human pumps in heart lungs machine and corrosive transport of fluids where the contact of fluid with machinery parts is prohibited"(p.1048) .[6] .

In[7] and his publication [8] that describes anincrease in thermal conductivity anomalously in the main fluid with theaddition of small fractions of nanoparticles volume, there hasbeen a great sake for research both experimental and theoretical of nanofluids. The worthwhile work on nanofluid has been paying attention to thermal conductivity measurements as a function of concentration, temperature, and particle size.. [9] An inflated forcopper nanofluids at the first time that has more prominent increases than those ofoxide nanofluids trailed by a two step method. In the same way as , method and assessed make better progressivethermal conductivity of carbon nanotube-oil suspensions.measurements of the thermalconductivity of nanofluids with oxide nanoparticles [10] stand for transient hot wire (THW) method, the nanofluid significanceand the partial slip on the flow peristaltic of aJeffrey fluidmodel in channel of type that an asymmetric with different forms of wave was discussed via Akram and Nadeem [11]. Srinivas and Kothandapani [12] expressed way of the influences on the MHD peristaltic flow by the transfer of heat and mass through a porous space with compliantly walls .Soon after, [13,14] have adopting the thermal radiation of a gray fluid which is emitting and absorbing in non –scattering medium .More notes regularly on transport of peristaltic of an incompressible viscous fluid containing metallic nanoparticlesin anirregular conducting resolving and reducing via Akbar [15]. [16] have found information again about the influences of Ohmic heating and viscous dissipation on steady magneto hydrodynamics flow near stagnation point on an isothermal stretching sheet.Ghazi and Waleed analyze in [17] the influences of the porous medium on unsteady transport of helical when generalized fluid with two infinite coaxial circular cylinders.[18] analyzed the peristaltic flux impactingon entropy generation of nanoparticles in a rotationally frame .To the extremely important of our knowledge , there is no fulfillmentundertaking yet about the nanofluids hyperbolic tangent in a tapered with an asymmetric channel. Therefore, the principle effective that present paper is to announced the various effects of the parameters related bythermal radiation and heat source/absorb and with peristaltic flowing of a tangent hyperbolic nanofluid model via effect of inclined magnetic field. [19] just like , MHD out of porous mediumduring peristaltic transporting of an asymmetric channels as construed .Executed of the heat and mass transfer effects in an inclined asymmetric channel through porous medium under Influence magnetic field [20] The closeform is inaugurated and finished under the assumptions of small Reynold (R_e) number and long wavelength. The graphical effects of the problem established under discussion are also added to display the related equations performance resulting invariant considered physical
parameters.

Formulation The Problem:

We considered the MHD of a two dimensional flow , withvertical tapered an asymmetric channel walls , conductinghyperbolic tangent nanofluid by an electrically ,under the impacts of transfer of heat by radiation and heat source/ sink parameters.

temperature $T_0$and nanoparticle volumefractionC_0,
temperatureT_1 and nanoparticlevolume fraction C_1.
The geometry of the tapered asymmetric surface is defined as

$$H_1(X,t') = -d - m'x - a_1 \sin\left(\frac{2\pi}{\lambda}(x - ct') + \varphi\right) \tag{1}$$

$$H_2(X,t') = d + m'x - a_2 \sin\left(\frac{2\pi}{\lambda}(x - ct')\right) \tag{2}$$

Where$Y = H_1$and $Y = H_2$ be left side wall and right side wall boundaries , $a_1$and a_2 presents the wave amplitudes of left and right walls respectively,
d is the half-width channel, $c$is the speed of the wave,
$\lambda$is the wave length, the difference φ varies in the range$0 \le \varphi \le \pi$,
$\varphi = 0$ correspondingto symmetric channel with waves out o and
$\varphi = \pi$ the wavesare in phase, a_1, a_2, d and φ satisfy the following conditional channel

$$a_1^2 + a_2^2 + 2a_1a_2\cos(\varphi) \le (2d)^2 \tag{3}$$

$$S = -PI + \tau \tag{4}$$

Which uses $(-PI)$ as the spherical part of the stress tensors related to constraint relation of nanofluid incompressible.

The Governing Equations :

The related governing equations of motion of hyperbolic tangent nanofluid and an incompressibility , with impacts of inclined magnetic field and radiation parameter are:

The continuity equation..

$$\frac{\partial U'}{\partial X'} + \frac{\partial V'}{\partial Y'} = 0 \tag{5}$$

The momentum equations ..

-The momentum equations of X

$$\rho_f\left(U'\frac{\partial U'}{\partial X'} + V'\frac{\partial U'}{\partial Y'}\right) - \rho_f\Omega\left(\Omega U' + 2\frac{\partial V'}{\partial t'}\right) = -\frac{\partial P'}{\partial X'} + \frac{\partial}{\partial X'}\left(S_{XX}\right)$$
$$+\frac{\partial}{\partial Y'}\left(S_{XY}\right) - \sigma B_0^2\cos\gamma\left(U\cos\gamma - V\sin\gamma\right) + \rho_f g\alpha(T - T_o) \tag{6}$$
$$+\rho g\sin\Omega - \frac{\eta_o}{k}(U + c)$$

-The momentum equations of Y

$$\rho_f\left(U'\frac{\partial V'}{\partial X'} + V'\frac{\partial V'}{\partial Y'}\right) - \rho_f\Omega\left(\Omega V' + 2\frac{\partial U'}{\partial t'}\right) = -\frac{\partial P'}{\partial Y'} + \frac{\partial}{\partial X'}\left(S_{XY}\right) \tag{7}$$
$$+\frac{\partial}{\partial Y'}\left(S_{YY}\right) - \sigma B_0^2\sin\gamma\left(U\cos\gamma - V\sin\gamma\right) + \rho g\cos\Omega - \frac{\eta_o}{k}V$$

The energy equation

$$(\rho C)_f\left(U'\frac{\partial T'}{\partial X'}+V'\frac{\partial T'}{\partial Y'}\right)=k\left(\frac{\partial^2 T'}{\partial X'^2}+\frac{\partial^2 T'}{\partial Y'^2}\right)+\phi_0-\frac{\partial q_r}{\partial Y} \quad \textbf{(8)}$$

Where U,V are the combination of velocity along $X$and Ydirections respectively, t'isthe dimensionless time,g is the acceleration due togravity, $P$is the pressure,σ is the electrical conductivity of the fluid,$B_0$is the magnetic field uniformly applying ,ρ_f is the constant densityof the base fluid, ,μ is the coefficient of viscosity of the fluid,κ is the thermalconductivity,,Q_0 is the constantheat addition/absorption, $\gamma$is the inclination of the magnetic field,Ω isthe angle of the inclination, .

In the laboratory coordinate$\left(X',Y'\right)$ direction flow , it can be unsteady. if observed a coordinate system moving at wave speed c in the wave frame.

In the two frames ,the relationship between them as the coordinate, velocities ,pressure , and temperature are

$$x'=X'-ct',y'=Y',u'=U'-c,v'=V',p'=P',T=T', \quad \textbf{(9)}$$

In order to simplify governing equations of the fluid flow , a dimensionless form, we introduce the following quantities in (1),
(2)–(10),

$$x'=\frac{X}{\lambda},y'=\frac{Y}{d},t=\frac{ct'}{\lambda},u'=\frac{U}{c},v'=\frac{V}{c},\delta=\frac{d}{\lambda},h_1=\frac{H_1}{d},h_2=\frac{H_2}{d}$$

$$p=\frac{d^2P}{c\lambda\eta_0},\theta=\frac{T-T_0}{T_1-T_0},a=\frac{a_1}{d},b=\frac{a_2}{d},m=\frac{\lambda m'}{d},\ \overline{S_{\bar{X}\bar{X}}}=\frac{\lambda}{\eta_0 c}S_{XX},\ \overline{S_{\bar{X}\bar{Y}}}=\frac{d}{\eta_0 c}S_{XY},\ \overline{S_{\bar{Y}}} \quad \textbf{(10)}$$

$$\frac{d}{\eta_0 c}S_{YY},\bar{\dot{\gamma}}=\frac{\dot{\gamma}d}{c},R=\frac{\rho_f cd}{\eta_0},\ \beta=\frac{Q_0d^2}{(T_1-T_0)\upsilon\, c_p'},Gr=\frac{\rho g\alpha d^2(T_1-T_0)}{c\eta_0},M=\sqrt{\frac{\sigma}{\mu}}\,dB_0,$$

$$Fr=\frac{c^2}{gd},We=\frac{\Gamma c}{d},Pr=\frac{\eta_0 c_f}{\kappa},$$

The radiative heat flux given by $q_r=-\dfrac{16\sigma*T_0^3\partial T}{3k*\partial Y}$, $\sigma*$ represent the Stefan-Boltzmann constant , and $k*$ is the mean absorption coefficient .

Substituting (10) into equations (6)-(8), we obtain the following non-dimensional equations and boundary conditions :

Then by using the stream function component $u=\frac{\partial\psi}{\partial y},v=-\delta\frac{\partial\psi}{\partial x}$ and omitting bar, we obtain :

$$\begin{aligned}&R_e\delta(\psi_y\psi_{xy}-\psi_x\psi_{yy})-\frac{\rho_f d^2\Omega^2}{\eta_o}\psi_y+2\frac{\rho_f cd^2\Omega^2}{\lambda\eta_o}\delta^2\psi_{xt}=-\frac{\partial p}{\partial x}\\&+\delta^2\frac{\partial S_{xx}}{\partial x}+\frac{\partial S_{xy}}{\partial y}-M^2\cos\gamma(\psi_y\cos\gamma+S\psi_x\sin\gamma)+G_r\theta\\&+\frac{R_e}{F_r}\sin\Omega-D(\psi_y+1)\end{aligned} \quad \textbf{(11)}$$

Where $D = \frac{d^2}{k}$

$$R_e\delta^3(-\psi_y\psi_{xx} - \delta\psi_x\psi_{yy}) + \frac{\rho_f d^2\Omega^2}{\eta_o}\delta^2\psi_x + 2\frac{\rho_f c d^2\Omega^2}{\lambda\eta_o}\delta^2\psi_{yt} = -\frac{\partial p}{\partial y}$$
$$+\delta^2\frac{\partial S_{xy}}{\partial y} + \delta\frac{\partial S_{yy}}{\partial y} - \delta M^2\sin\gamma(\psi_y\cos\gamma + S\psi_x\sin\gamma)$$
$$+\frac{R_e}{F_r}\cos\Omega + \delta D\psi_x \quad (12)$$

$$R_e\delta\left(\psi_y\frac{\partial\theta}{\partial x} - \psi_x\frac{\partial\theta}{\partial y}\right) = \frac{1}{p_r}\delta^2\frac{\partial^2\theta}{\partial y^2} + \frac{1}{p_r}\frac{\partial^2\theta}{\partial y^2} + \beta + R_n\frac{\partial^2\theta}{\partial y^2} \quad (13)$$

$$S_{xx} = 2[1 + n(We\gamma - 1)]\frac{\partial^2\psi}{\partial x\partial y},$$
$$S_{xy} = [1 + n(We\gamma - 1)]\left(\frac{\partial^2\psi}{\partial y^2} - \delta^2\frac{\partial^2\psi}{\partial x^2}\right), \quad (14)$$
$$S_{yy} = -2\delta[1 + n(We\gamma - 1)]\frac{\partial^2\psi}{\partial x\partial y},$$

Where x is non-dimensional axial coordinate,y is non-dimensional transverse coordinate, t is dimensionless time,u and v are dimensionless axial and transverse velocity components,p is dimensionless pressure a and b are component of amplitudes of left and right walls respectively, $\delta$is wave number, m is parameter of the non—uniform, β is heat source/sink parameter ,$(R_e)$is the Reynolds number,(θ) is the dimensionless temperature,(M) Hartmann number,(Fr)Froude number, Gr is local temperature Grashof number, R_n is the radiation parameter, N_t is thermophoresis parameter .

Under assumption of long wavelength that $(\delta \ll 1)$and low-Reynolds number (negligent) , (11)–(13)become

$$\frac{\partial p}{\partial x} = \frac{\rho_f d^2\Omega^2}{\eta_o}\psi_y + \frac{\partial S_{xy}}{\partial y} - M^2\cos^2\gamma\psi_y + G_r\theta + \beta + \frac{\text{Re}}{F_r}\sin\Omega \quad (15)$$
$$-D(\psi_y + 1)$$

$$\frac{\partial p}{\partial y} = 0$$
$$\frac{\partial^2\theta}{\partial y^2} + \frac{P_r}{1 + R_n P_r}\beta = 0 \quad (16)$$

The corresponding boundary conditions in terms of stream function are given as …

$$\frac{\partial p}{\partial x}=\frac{\rho_f d^2\Omega^2}{\eta_o}\psi_y+\frac{\partial}{\partial y}\left(1+n(We\frac{\partial^2\psi}{\partial y^2}-1)\right)\frac{\partial^2\psi}{\partial y^2}-M^2\cos^2\gamma\psi_y+G_r\theta$$
$$+\frac{\mathrm{Re}}{F_r}\sin\Omega-D(\psi_y+1)+\beta \qquad (17)$$

$$\frac{\partial p}{\partial y}=0 \qquad (18)$$

Solution of ψ equation :

We communicate the solution and results for the stream function , via perturbation method and Mathematica software with small parameter We (Weissenberg number),expanding $\psi, P\ and\ F$ in the following expression

$$\psi=\psi_0+We\,\psi_1+o(\psi) \qquad (19)$$
$$p=p_0+We\,p_1+o(p) \qquad (20)$$
$$F=F_0+We\,F_1+0(F) \qquad (21)$$

$$\frac{\rho_f d^2\Omega^2}{\eta_o}\psi_{yy}+\frac{\partial^4\psi}{\partial y^4}+nWe(2\psi^2{}_{yyy}+2\psi_{yy}\psi_{yyyy})-n\frac{\partial^4\psi}{\partial y^4}-M^2\cos^2\gamma\frac{\partial^2\psi}{\partial y^2}$$
$$G_r\frac{\partial\theta}{\partial y}-D\frac{\partial^2\psi}{\partial y^2}=0 \qquad (22)$$

Substituting above expressions and collecting the small number powers We. then obtain the following :

A- *zeroth order*

$$\frac{\rho_f d^2\Omega^2}{\eta_o}\frac{\partial^2\psi_0}{\partial y^2}+(1-n)\frac{\partial^4\psi_0}{\partial y^4}-M^2\frac{\partial^2\psi_0}{\partial y^2}\cos^2\gamma+$$
$$G_r\frac{\partial\theta}{\partial y}-D\frac{\partial^2\psi_0}{\partial y^2}=0 \qquad (23)$$

$$\frac{\partial^4\psi_0}{\partial y^4}+\frac{1}{(1-n)}\left(\frac{\rho_f d^2\Omega^2}{\eta_o}-M^2\cos^2\gamma-D\right)\frac{\partial^2\psi_0}{\partial y^2}=\frac{G_r}{(1-n)}\frac{\partial\theta}{\partial y} \qquad (24)$$

$$\frac{\partial p_0}{\partial x}=(1-n)\frac{\partial^3\psi_0}{\partial y3}-M^2\frac{\partial\psi_0}{\partial y}\cos^2\gamma+G_r\theta+\frac{\mathrm{Re}}{F_r}\sin\Omega \qquad (25)$$
$$-D(\frac{\partial\psi_0}{\partial y}+1)+\frac{\rho_f d^2\Omega^2}{\eta_o}\frac{\partial\ \psi_0}{\partial y}$$

For the example of the zeroth order :

$$\psi_0 = c3 + yc4 + \frac{\frac{Gry^2}{h1-h2} + 2e^{-\frac{y\sqrt{A_3}}{\sqrt{-1+n}}}(-1+n)c1 + 2e^{\frac{y\sqrt{A_3}}{\sqrt{-1+n}}}(-1+n)c2 - \frac{1}{2}Gr(h1+h2)y^2\beta A_2 + \frac{1}{3}Gry^3\beta A_2}{2A_2};$$

B- *first order*

$$\frac{\rho_f d^2\Omega^2}{\eta_o}\frac{\partial^2\psi_1}{\partial y^2} + (1-n)\frac{\partial^4\psi_1}{\partial y^4} - +2n\left(\frac{\partial^3\psi_0}{\partial y^3} + \frac{\partial^2\psi_0}{\partial y^2}\frac{\partial^4\psi_0}{\partial y4}\right) - M^2\frac{\partial^2\psi_1}{\partial y^2}\cos^2\gamma - D\frac{\partial^2\psi_1}{\partial y^2} = 0 \tag{26}$$

$$\frac{\partial p_1}{\partial x} = \frac{\rho_f d^2\Omega^2}{\eta_o}\frac{\partial\ \psi_1}{\partial y} + (1-n)\frac{\partial^3\psi_1}{\partial y3} - M^2\frac{\partial\psi_1}{\partial y}\cos^2\gamma - D(\frac{\partial\psi_1}{\partial y}) + 2n\frac{\partial^2\psi_o}{\partial y^2}\frac{\partial^3\psi_o}{\partial y^3} \tag{27}$$

For the example of the first order :

$$\psi_1 = c7 + yc8 + \frac{1}{12A_3^3}(-12Gr^2ny^2\beta^2A_2^2 + 4c1^2e^{-\frac{2y\sqrt{A_3}}{\sqrt{-1+n}}}nA_3^2 + 4c2^2e^{\frac{2y\sqrt{A_3}}{\sqrt{-1+n}}}nA_3^2 + 12e^{-\frac{y\sqrt{A_3}}{\sqrt{-1+n}}}(-1+n)c5A_3^2 + 12e^{\frac{y\sqrt{A_3}}{\sqrt{-1+n}}}(-1+n)c6A_3^2$$
$$+ \frac{3c2e^{\frac{y\sqrt{A_3}}{\sqrt{-1+n}}}Grn\sqrt{A_3}(-10\sqrt{-1+n}\sqrt{A_3} + 4yA_3 + (h1-h2)\beta A_2(3-3n+\sqrt{-1+n}(5h1+5h2-2y)\sqrt{A_3} - 2(h1+h2-y)yA_3))}{(h1-h2)\sqrt{-1+n}}$$
$$+ \frac{3c1e^{-\frac{y\sqrt{A_3}}{\sqrt{-1+n}}}Grn\sqrt{A_3}(-2(5\sqrt{-1+n}\sqrt{A_3} + 2yA_3) + (h1-h2)\beta A_2(3(-1+n) + \sqrt{-1+n}(5h1+5h2-2y)\sqrt{A_3} + 2(h1+h2-y}{(h1-h2)\sqrt{-1+n}}$$

The corresponding boundary conditions in terms of stream function are given as

$\psi = \frac{F}{2}$, $\frac{\partial\psi}{\partial y} = 0$

When

$y = h_2 = 1 + mx + b\sin\big(2\pi(x-t)\big)$, and

$\psi = -\frac{F}{2}$, $\frac{\partial\psi}{\partial y} = 0$,

$y = h_1 = -1 - mx - a\sin(2\pi(x-t) + \varphi)$,

$$\left.\begin{array}{ll} \theta = 1\ and\ \sigma = 1 & \text{at } y = h_2, \\ \theta = 0\ and\ \sigma = 0 & \text{at } y = h_1, \end{array}\right\}$$

The time- averaged flow over A period $\left(T = \frac{\lambda}{c}\right)$at a fixed position X is defined as..

$$Q = \frac{1}{T}\int_0^T \bar{Q}\ d\bar{t}$$

Integration of (16) with respect to y and apply boundary condition of (27) , the dimensionless temperature field is obtained as

$$\frac{\partial^2\theta}{\partial y^2} - + \frac{P_r}{1+R_n P_r}\beta = 0 \tag{28}$$

$$\theta = \frac{1}{2}(h_1 - y)(\frac{2}{h_1 - h_2}) + (y - h_2)\beta\frac{P_r}{1+R_n P_r} \tag{29}$$

GRAPHICAL RESULTS AND DISCUSSION

This results of graphical section of axial velocity ,pressure average rising , temperature, reduce nanoparticle concentration and streamlines are devoted in Figures 1–11. Where the equation is solved numerically in Mathematica program .Nowadays, the nanoparticles and nanofluids have a huge applications in field of technology that built in the near future . Now days , attention a new weapon in the arsenal to fight cancer disease concentrates on it , also focuses such as the advances explore in areas such as improved drug delivery, energy conversion, material properties, and fluid transport and heat transfer. To present influence of power law index number that an increase in the trapping . The Thermophoresis parameter Nt is a non-dimensional parameter that describes the response of the suspended particles to the force of the temperature gradient. The nanofluid velocity, temperature, and concentration that exhibits the increasing in the curvature parameter far from the stretching surface while they show the reverse near the stretching surface. The nanofluid temperature decrease with the increase in the Prandtl number.

The effect of N_b , m and R_n on the transfer of heating and nanoparticales mass transfer distribution are show increasing of the heat transfer with 

increasing of parameters . It is concluded that the scheme of trapping enhances with increasing the effect of porosity , As a result it reduces with increasing the effect of heat transfer .The formation of bolus of the fluid by closed streamline is called trapped bolus pulled ahead a long with peristaltic wave .One can observe that the size of trapped decreases with increase in W_e .An increasing in Reynolds model viscosity reduce size of trapped bolus . then can represent behavior for the fixed values of axial velocity other parameters , that produce the velocity increase as β increase at y in interval[-3,3]. The results are described by graphical clarifications while Mathematica program was used to obtain results .

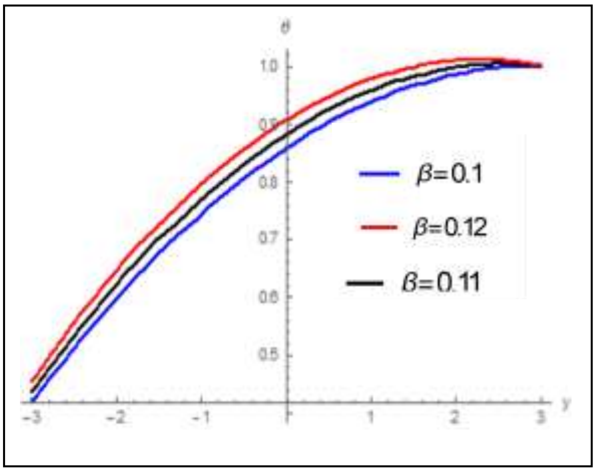

Figure 1: This figure represents effects of different values of (β) on temperature profile at $\{m = 0.5, \varphi = \frac{3\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, n = 0.2, t = 0.2, R_n = 2, a = 1.5, b = 0.5, x = 5\}$.

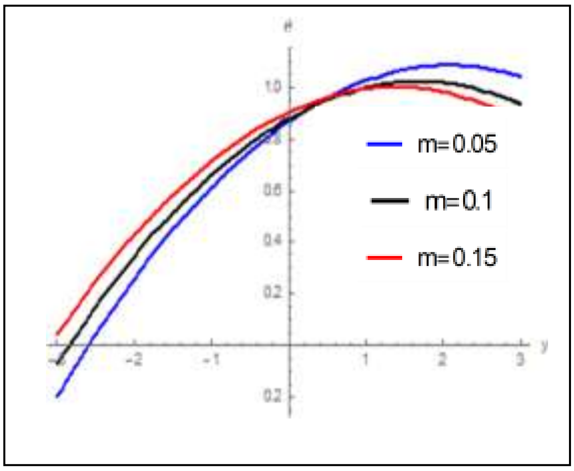

Figure 2: This figure represents effects of different values of (m) on temperature profile at $\{\beta = 0.3, \varphi = \frac{3\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, n = 0.2, t = 0.2, R_n = 2, a = 1.5, b = 0.5, x = 5\}$.

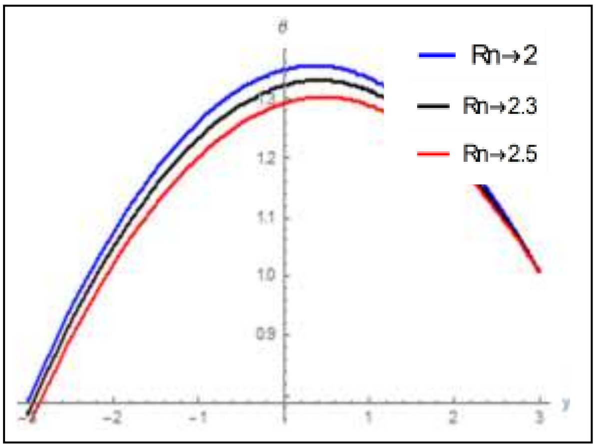

Figure 3: This figure represents effects of different values of (R_n) on temperature profile at $\{m = 0.5, \varphi = \frac{3\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, n = 0.2, t = 0.2, \beta = 0.3, a = 1.5, b = 0.5, x = 5\}$.

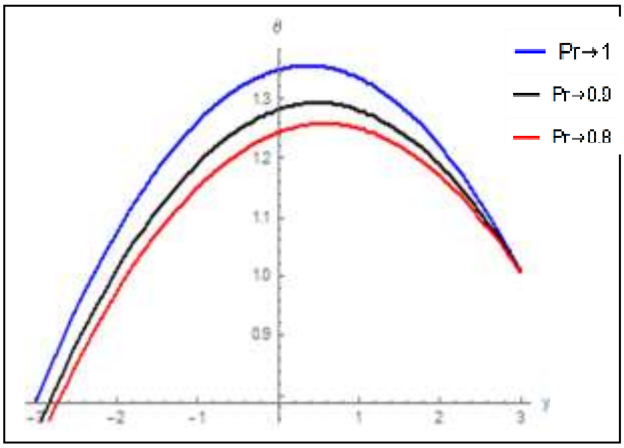

Figure 4 :This figure represents effects of different values of (p_r) on temperature profile at $\{m = 0.5, \varphi = \frac{3\pi}{4}, \gamma = \frac{\pi}{6}, R_n = 2, G_r = 0.5, n = 0.2, t = 0.2, \beta = 0.3, a = 1.5, b = 0.5, x = 5\}$.

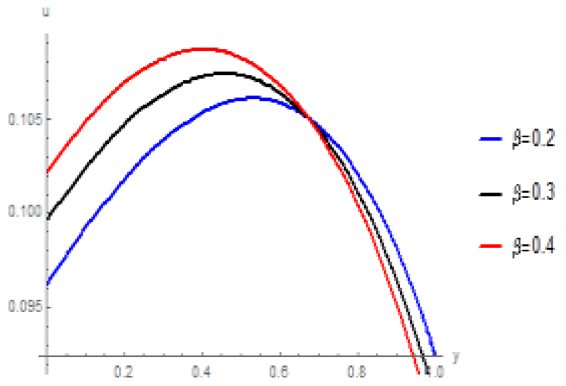

Figure 5 : Different values of (β) effects on Nano axial velocity distribution ,with $\{m = 0.2, M = 2, W_e = 0.1, \emptyset = \frac{\pi}{4}, \gamma = \frac{\pi}{6},$ $p_r = 1, G_r = 0.5, d = 0.2, n = 0.2$, η_0 =0.1, $a = 1.5, b = 0.5$, $x = 0.1, F_r = 3, R_e = 0.2, \theta = 0.3,$ $\Omega = 0.11$ *and* $\rho = 0.9$ }

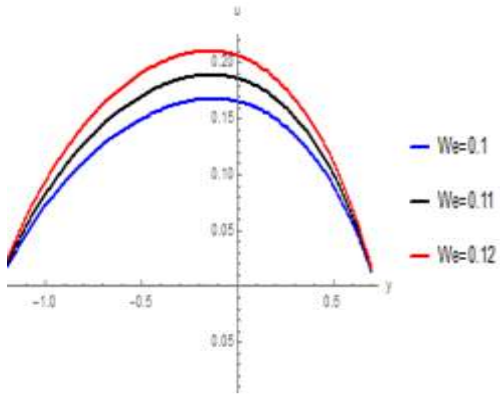

Figure 6: Different values of (W_e) effects on Nano axial velocity distribution ,with $\{m = 0.2, M = 2,$ $\beta = 0.2, \emptyset = \frac{\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, d = 0.2,$ $n = 0.2, 1 = 0.2,$ η_0 =0.1, $a = 1.5, b = 0.5$, $x = 0.1, F_r = 3, R_e = 0.2, \theta = 0.3,$ $\Omega = 0.11$ *and* $\rho = 0.9$ }

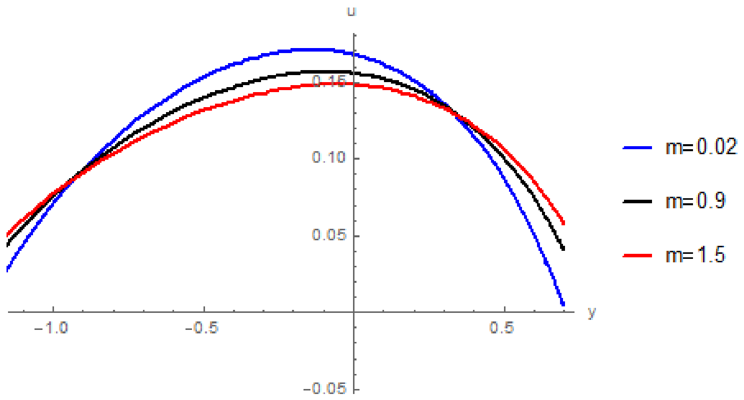

Figure 7: Different values of (m) effects on Nano axial velocity distribution ,with $\{M = 2, W_e = 0.1, \emptyset = \frac{\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, d = 0.2, n = 0.2, \beta = 0.2,$ η_0 =0.1, $a = 1.5, b = 0.5$, $x = 0.1, F_r = 3, R_e = 0.2$, $\theta = 0.3,$ $\Omega = 0.11$ *and* $\rho = 0.9$ }

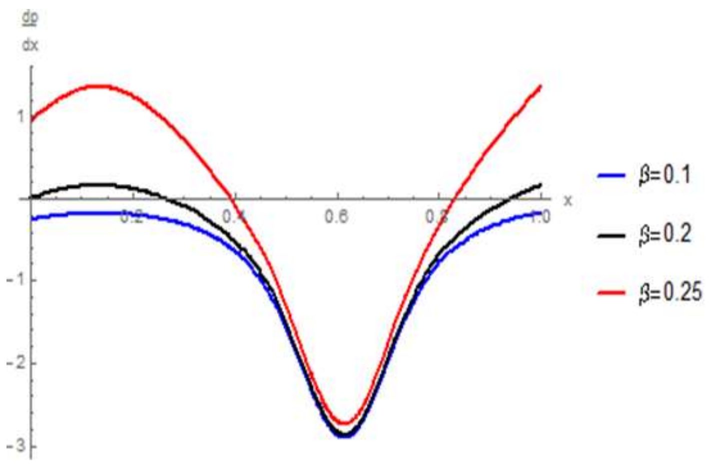

Figure 8: Influence of pressure gradient $\frac{dp}{dx}$ vs. axial distance (x) for different values of (β) with Various instant

$m = 0.2, M = 2, W_e = 0.2, F_0 = 0.2, F_1 = 0.3, , \phi = \frac{3\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, y = 0.5, F_r = 3$
$n = 0.2, t = 0.2, \eta_0 = 0.1, \Omega = 0.11, = 0.3, R_n = 2, a = 1.5, b = 0.5, \rho = 0.9, v = 0.1, d = 0.2, R_e = 0.2$

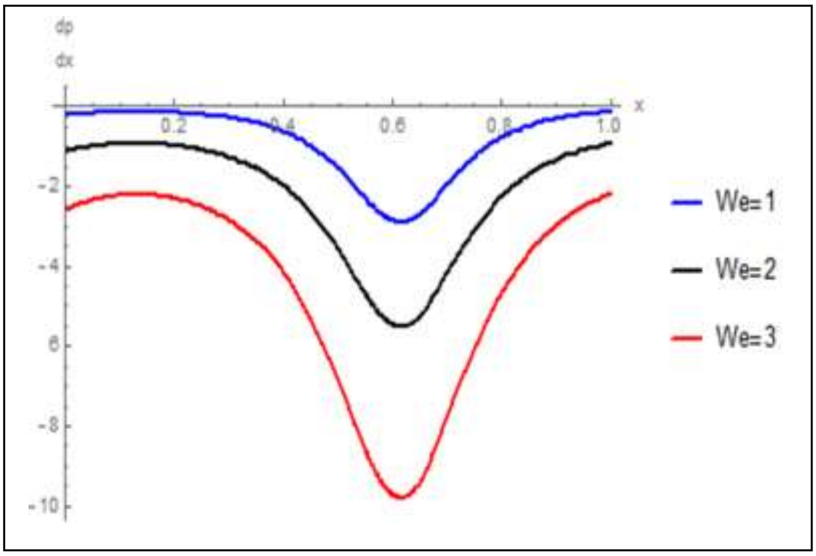

Figure 9: Influence of pressure gradient $\frac{dp}{dx}$ vs. axial distance (x) for different values of W_e with Various instant

$m = 0.2, M = 2, \beta = 0.2, F_0 = 0.2, F_1 = 0.3, , \phi = \frac{3\pi}{4}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5, y = 0.5, F_r = 3$
$n = 0.2, t = 0.2, \eta_0 = 0.1, \Omega = 0.11, = 0.3, R_n = 2, a = 1.5, b = 0.5, \rho = 0.9, v = 0.1, d = 0.2, R_e = 0.2$

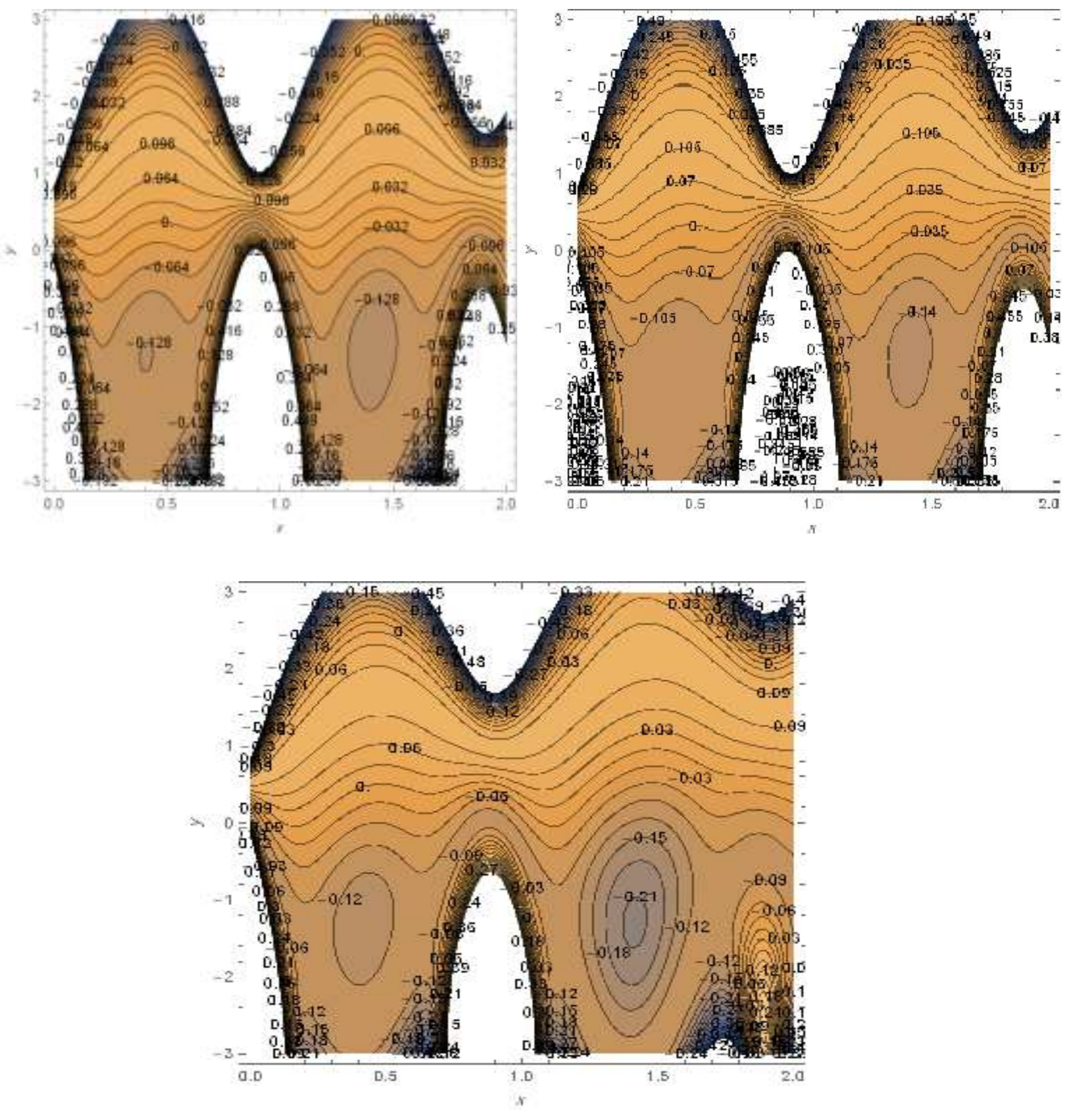

Figure 10: Stream lines for different values of.**(a)** w_e =0.004 ,**(b)** w_e =0.04 ,**(c)** w_e =0.08 , and Various parameters are

$$m = 0.2, M = 0.7, \beta = 0.5, F_0 = 0.2, F_1 = 0.3, , \phi = \frac{\pi}{8}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5,$$
$$n = 0.2, t = 0.2, \eta_0 = 0.1, \Omega = 0.11, = 0.3, R_n = 2, a = 1.5, b = 0.5, \rho = 0.9, v = 0.1, d = 0.2$$

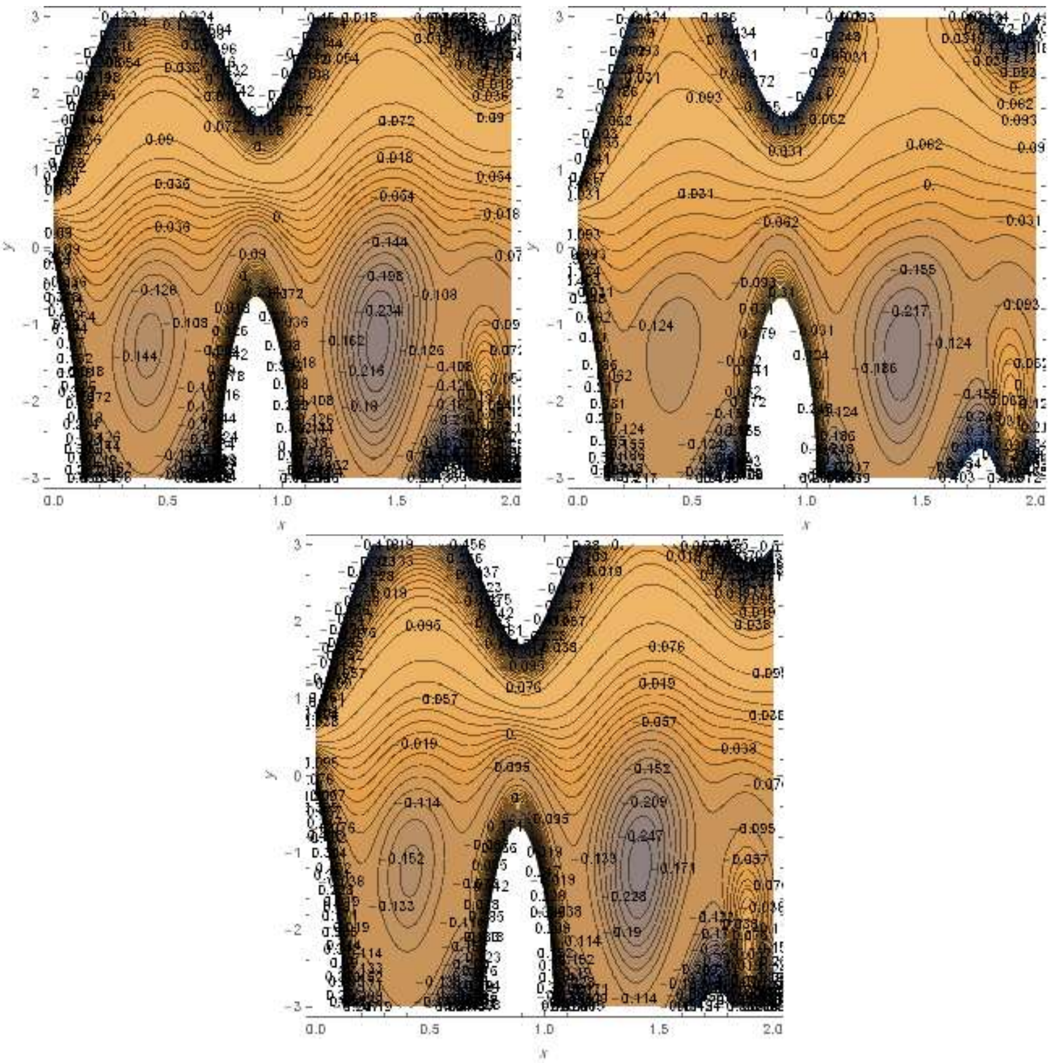

Figure 11: Stream lines for different values of **(a)** β =1 **(b)** β =1.5 **(c)** β =2 ,With Various parameters are $m = 0.2, M = 0.7, W_e = 0.004, F_0 = 0.2, F_1 = 0.3, , \phi = \frac{\pi}{8}, \gamma = \frac{\pi}{6}, p_r = 1, G_r = 0.5,$ $n = 0.2, t = 0.2, \eta_0 = 0.1, \Omega = 0.11, = 0.3, R_n = 2, a = 1.5, b = 0.5, \rho = 0.9, v = 0.1, d = 0.2$

Conclusion

In this Paper, The effect of the heat source, and inclined magnetic field in the tapered asymmetric channel peristaltic move of nanofluid through a porous medium have been studied . The channel asymmetric is produced by expressing the peristaltic waves which has different amplitude and phases , low Renolds number and a long wavelength. The perturbation solution used to obtain expression of the axial velocity , temperature, stream function and pressure gradient is adapted .

A. We note that the temperature profile as effects of β , m, Rn and Pr show on heat transfer. Such that increase in β and m that different behavior about effects of Rn and Pr is in the highest at near the center of channel .

B. Velocity profile , Generally it parabolic and it is decreasing with the increase value of m, and the increasing of β and We that increase in on nano axial velocity distribution .

C. contraction of channel , enhancing by radiation variable on the walls ,impacts of different physical parameters observing into the problem tested via numerical and graphical method.

D. Figures (8-9) show the alteration of pressure gradient against axial coordinate x for various wave forms . where the pressure gradient decrease with increasing in W_e and β .
E. Trapping is also useful phenomenon of peristaltic flow , in graping the motion of gastrointestinal tract and the arrangement of thrombus . Finally , it is concluded that the trapping enhances with the increase of porosity effective, whereas it reduces with increasing the effect of heat transfer .

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