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Heat Transfer Reaction on a Viscous Dissipative Free Convective Radiating Stream over a Permeable Laminate within Presence of Induced Magnetic Field

P.Pramod Kumar, Bala Siddulu Malga, Sweta Matta, Lakshmi Appidi

Abstract: ***The fundamental point of the paper is to inspect the heat transfer consequence on a viscous dissipative unconfined convective Radiating stream over a permeable shield in the existence of induced- magnetic flux. Consistent magnetic field of force will be applied vertically towards the plate which is electrically non-conducting. Partial differential equations which are non linear coupled worked out by Galerkin technique, the consequence of Radiation with Heat source parameter and other physical features on velocity, temperature along with induced-magnetic field are explained by graphs.***

Keywords: Radiation induced-magnetic, Heat source, Magnetic Prandtl number, Galerkin Finite Method, Free convection.

I. INTRODUCTION

As we know that in aerodynamics and science & space technology, Radiation plays a significant role. Consequence of radiation together with Prandtl number, with steady mixed convective mass as well as heat transfer stream about optically lean gray gas is examined through mathematical solutions. The analytical solutions under Galerkin finite element gives us a wide range of applications, in perceptive fundamental chemistry and physics problems, in particular very helpful in technological also industrial fields. In nature and industrial process we often come across unconfined convection flow relating heat with mass transfer. In dispersion of fog, designing the chemical processing unit, and havoc of crops due to freeze, in these fields, heat along with mass transfer collectively plays a prime part. Induced-magnetic field forces alter the stream flow and which effects outside pressure gradient on the borderline layer. In polymer industry radiation reaction on the borderline layer plays a complicated part in managing the heat transfer and within coming the final product.

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In manufacturing industries emission heat transfer plays a prime part within designing the consistent equipment, satellites and space automobiles are illustrations of such manufacturing applications. Rashid et al [1] has reviewed a steady viscous elastic fluid passing through a penetrable medium of laminar free convection stream two dimensionally. Chen [2]. Examine the MHD on an inclined laminate by considering the Ohmic warm and viscous dissipation. Ravi Kumar et al [3] has investigated MHD dual diffusive with chemical reactive stream passing throughout two vertical plates of a permeable medium. Raju et al [4] interpreted the mass transfer along with radiation influence on the unconfined convection flow of a penetrable medium which is enclosed by an erect shell. Effect of an uneven suction on a semi-infinite perpendicular laminate of MHD convective heat transmits of a spongy medium was examined by Kien [5]. Takhar et al [6] has considered the impact of united magnetic field on an uneven stream along with heat change on a semi-infinite plate. Siddiqal together with Husain [7] explained the borderline layer flow through a sharp plate with emission heat transfer by considering mixed convection. Ahmed as well as Tridip 2010 [8] looks over the result of thermal emission and heat transfer periodic suction. M.C.Raju et al [9] have investigated the outcome of heat transmits in the presence of induced- magnetic field lying on a dissipative liquid passed through a erect laminate. Bhatta charaya et al. [10] has investigated the varied convective borderline cover slip stream through a perpendicular shell by using similarity solution. The effect of variable suction and temperature along with combined results convective Rivlin-Ericksen stream past through a semi- infinite erect permeable plate was discussed by Ravi Kumar et al [11]. Raju et al[12] has studied MHD convective stream in a horizontal canal within existence of viscous dissipation together with joule heating through a penetrable medium. Raptis as well as Soundalgekar [13] examined unconfined stable laminar convection stream along a spongy hot perpendicular plate within existence of heat source. Chamkha [14] analyzed steady MHD borderline layer stream through a semi-infinite surface within the existence thermal radiation. Chamkha along with Issa [15] was analyzed the impact of heat inclusion or heat exclusion on a MHD stream with heat and mass change of a smooth surface.

Result of chemical influence on heat and mass transfer of a borderline layer flow with heat generation or heat inclusion was investigated by Chamkha [16].

Savic together with Steinruck [17] has investigated the varied convection flow past through a horizontal laminate. J Prakash et al [18] studied the reaction of emission and induced-magnetic flux on MHD stream above a permeable vertical laminate in existence of magnetic dissipation. Ahmed [18] studied the magnetic dissipation enclosed by a erect plate within the existence of thermal emission by introducing a mathematical model. Raptis et al [19] has investigated stream of an electrically conduct fluid passed through a kinetic erect unbounded plate with heat unvaried flux along with suction at laminate with induced-magnetic field. England and Emery [20] considered the impact of emission on an optically narrow gray gas fenced by a plate which is static. M.C.Raju et al. [21] examined of heat transmits on a viscous destructive stream past a erect plate within the existence of induced-magnetic force of field. The present paper is an extension M.C. Raju et al. by adding Radiation parameter (R) and studying the consequence of flow features such as Magnetic field, Magnetic Prandtl and, Eckert number, Heat source, Prandtl number, on velocity profile, Induced-magnetic profile and Temperature.

II. MATHEMATICALMETHOD

Let us consider a stable MHD varied convective heat transfer stream of a Newtonian, thick dissipative in-compressible stream through a penetrable erect infinite plate with magnetic dissipation or viscous. Vertically towards the plate is considered as x-axis, and at right angles to the plate in direction of fluid is considered as y- axis. Let us imagine a consistent magnetic force (H_0) is applied at right angles to the plate which is electrically non-conducting. Let us consider that plate is in $\bar{x}$-direction and stream is parallel to the plate. Let $(\bar{u}, \bar{v}, 0)$ is the velocity of the fluid and $(\bar{H}_x, \bar{H}_y, o)$ is the magnetic-induction vector $(\bar{x}, \bar{y}, \bar{z})$ in liquid. Physical parameters are free of $\bar{x}$ excluding the force, since the laminate is persistent length in $\bar{x}-$ direction. The partition is maintained at invariant temperature. $\bar{T}_w$ is larger than ambient temperature $\bar{T}_\infty$. Properties of the gas measured as constants excluding the density deviation with temperature. The shield is focused to a stable suction velocity. Conservation of electric is $\nabla . J = 0$ and $J = (J_x, J_y, J_z)$ direction of propagation is across the $\bar{y} - axis$ and there is no change across $\bar{y} - axis$, then $\frac{\partial J_y}{\partial y} = 0$, which gives$J_y = constant$. Under the above inferences, the stream is managed with x- energy equation.

$$\bar{v}\frac{\partial \bar{u}}{\partial \bar{y}} = -\frac{1}{\rho}\frac{\partial p}{\partial x} - g + v\frac{\partial^2 \bar{u}}{\partial \bar{y}^2} + \frac{\mu_0 H_0}{\rho}\frac{\partial \bar{H}_x}{\partial \bar{y}}$$
(1)

First term in equation (1) of RHS gives the mixed convection term. Viscous expression in the above equation disappears since the velocity is insignificant. In the nonexistence of induced-magnetic field contain

$$\frac{\partial p}{\partial x} = -\rho_\infty g$$
(2)

extract pressure from Eq's. (1) & (2), and by Boussineqs approximation $\rho_\infty - \rho = \rho_\infty \beta(\bar{T} - \bar{T}_\infty), then$ equation(1) becomes as

$$\bar{v}\frac{\partial \bar{u}}{\partial \bar{y}} = g\beta(\bar{T} - \bar{T}_\infty) + v\frac{\partial^2 \bar{u}}{\partial \bar{y}^2} + \frac{\mu_0 H_0}{\rho}\frac{\partial \bar{H}_x}{\partial \bar{y}}$$
(3)

Energy along with magnetic induction are as fallows

$$\bar{v}\frac{\partial \bar{T}}{\partial \bar{y}} = \frac{k}{\rho C_p}\frac{\partial^2 \bar{T}}{\partial \bar{y}^2} + \frac{v}{C_p}\left(\frac{\partial \bar{u}}{\partial \bar{y}}\right)^2 + \frac{1}{\sigma \rho C_p}\left(\frac{\partial \bar{H}_x}{\partial \bar{y}}\right)^2 - \bar{Q}\frac{\partial}{\partial y}(\bar{T}_\infty - \bar{T})$$
(4)

$$\bar{v}\frac{\partial \bar{H}_x}{\partial \bar{y}} = \frac{1}{\rho \mu_0}\frac{\partial^2 \bar{H}_x}{\partial \bar{y}^2} + H_0\frac{\partial \bar{u}}{\partial \bar{y}}$$
(5)

Boundary conditions:

$$\left.\begin{array}{l} \bar{y} = 0 : \ \bar{u} = 0, \ \bar{v} = -v_0, \bar{T} = T_w, \ \bar{H}_x = 0 \\ \bar{y} \to \infty : \ \bar{u} \to U_0, \ \bar{T} \to \bar{T}_\infty, \qquad \bar{H}_x \to 0 \end{array}\right\}$$
(6)

Non- dimensional quantities are :

$$\left.\begin{array}{l} y = \frac{v_0 \bar{y}}{v} \quad u = \frac{\bar{u}}{U_0}, \quad \theta = \frac{\bar{T} - \bar{T}_\infty}{\bar{T}_w - \bar{T}_\infty}, \quad Pr = \frac{\rho v C_p}{k}, \\ \mathrm{Gr} = \mathrm{vg}\beta\left(\frac{\bar{T}_w - \bar{T}_\infty}{\mathrm{U_0 v_0^2}}\right), \ \mathrm{H} = \sqrt{\frac{\mu_0 \mathrm{H_x}}{\rho \mathrm{U_0}}}, \ \mathrm{Ec} = \frac{\mathrm{U_0^2}}{\mathrm{C_p}(\bar{T}_w - \bar{T}_\infty)} \\ \mathrm{Prm} = \sigma \mathrm{v} \mu_0, \quad \mathrm{M} = \sqrt{\frac{\mu_0 \mathrm{H_x}}{\rho \mathrm{v_0}}}, \mathrm{Q} = \frac{\mathrm{Q}^*}{\mathrm{v_0}}, \mathrm{R} = \frac{64 \alpha \mathrm{v} \bar{\sigma} \bar{\mathrm{T}}_\infty^3}{\rho \mathrm{v_0^2 C_p}} \end{array}\right]$$
(7)

$\frac{\partial q_r}{\partial \bar{y}} = -4a\bar{\sigma}(\bar{\mathrm{T}}_\infty^4 - \bar{\mathrm{T}}^4)$, 'a' mean inclusion, $\bar{\sigma}$ is the 'Stefan-Boltzmann' constant. from (7), the undimensional equations are in the form of ordinary differential equations are:

$$\frac{d^2 u}{dy^2} + \frac{du}{dy} + M\frac{dH}{dy} = -G_r \theta$$
(8)

$$\frac{d^2 \theta}{dy^2} + P_r\frac{d\theta}{dy} + \frac{P_r R}{4}\theta = \left(E_c P_r\left(\frac{du}{dy}\right)^2 + \frac{E_c P_r}{P_{rm}}\left(\frac{dH}{dy}\right)^2\right) + Q\frac{d\theta}{dy}$$
(9)

$$\frac{d^2 H}{dy^2} + MP_{rm}\frac{du}{dy} + P_{rm}\frac{dH}{dy} = 0$$
(10)

Boundary conditions in dimensionless form of equation (6) are:

$$\left.\begin{array}{l} u = 0, \ \theta = 1, \ H = 0, \ at\ y = 0 \\ u \to 1, \quad \theta \to 0, \quad H \to 0 \quad as\ y \to \infty \end{array}\right\}$$
(11)

Galerkin finite element put in an application for equation (8), (9) and (10) over a two nodded linear element (e) ($y_j \leq y \leq y_k$). Here h is the mesh size, the net consists of h=0.1 for, velocity, temperature along with induced-magnetic field profiles has been considered for calculation's for equations (8 – 10), taking' i = 1(1)n 'and applying the primary boundary condition (6) and (11) the following equations are obtained $A_i X_i = B_i$ where i=1,2,3…..

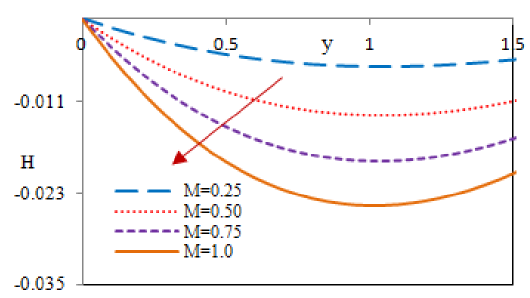
Let $A_i's$ is the matrix of order n and $X_i's$ and $B_i's$ are column matrices having n-components. Thomas algorithm method is applied to get the solution of above system of equations, for velocity,

Temperature together with induced magnetic fields, and numerical solutions of this mathematical problem are acquired by c-programme.
Changed values h and insignificant changes were noticed in profiles u, θ and H. Here we noticed that Galerkin finite element is stable and convergent.

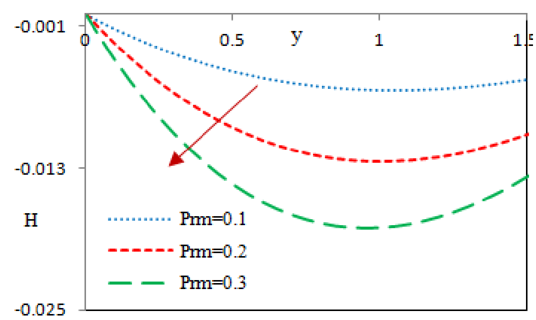
III. RESULT & DISCUSSIONS

In series to acquire objective immanent of issue we computed numerical results displayed for non-dimensional profiles like velocity (u), Induced-magnetic field (H) along with Temperature (T) with the help of graph illustrations. influence of physical parameters like Radiation (R), Hartmann (M), Magnetic Prandtl (Prm), Prandtl numbers (Pr) with heat source characteristic (Q), Eckert number (Ec) computations were conceded out for velocity, induced magnetic profile, with temperature. The numerical solutions are discussed from figure 1(a) - 1(g), 2(a) – 2(f), and 3(a) – 3(e). Figure 1(a) describes the impact of magnetic number (M) on induced-magnetic field profile. As the magnetic parameter becomes large, there will be a diminish in induced magnetic field. Figure 1(b) shows the result of magnetic Prandtl number (Prm) on induced-magnetic field profile. Observed there is drop in induced magnetic field as magnetic Prandtl number becomes large. Figure 1(c) reveals cause of Prandtl number (Pr) on induced magnetic field (H). it is seen that there is enhance in induced field as the Prandtl number rises. Figure 1(d) shows the reaction of Eckert number taking on induced-magnetic field. Observed that, increase in Eckert number there is a diminish in induced-magnetic profile. Figure 1(e) shows rise in heat source (Q), which leads to increase in induced magnetic field. Figure 1(f) displays the result of Radiation (R) on induced-magnetic profile. radiation increases then there is also in increase in induced magnetic field. Figure 1(g) shows impact of magnetic field parameter (M) with Prandtl number (Pr) for discrete values to cool the plate (Gr > 0) on induced magnetic field. Rise in magnetic field parameter (M), then there will be a drop in induced magnetic field for both conducting air (0.71) and water (7.0). Figure 2(a) – 2(c) shows the consequence of magnetic number (M), Prandtl number (Pr), with magnetic Prandtl number (Prm) on velocity (u). It is noticed that, as these parameters increases there is a diminish in velocity. Figure 2(d) reveals the results of Radiation (R) on velocity profile. Observed that, velocity decelerates as there is increase in radiation parameter. Figure 2(e) explains the cause of heat source (Q) on velocity. Rise in velocity as the heat source parameter increases. Figure 3(a) shows consequence of heat source (Q) on Temperature. The temperature profile increases as if heat source parameter becomes large. Figure 3(b) - 3(c) the influence of Prandtl number (Pr) along with Radiation (R) on Temperature. Noticed Temperature falls down as the Prandtl number with Radiation parameter increases. Figure 3(d) shows results of Prandtl number (Pr) with heat source parameter for different values to cool the plate (Gr > 0) on Temperature. Increase in heat source parameter (Q), then there is a raise in Temperature. Figure 3(e) influence of Prandtl number (Pr) for air (0.71), water (7.0) and different values of Radiation parameter on temperature profile. Enlarge in temperature as the radiation rises.

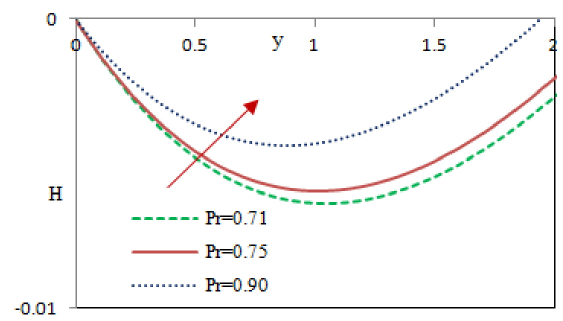
IV. GRAPHS



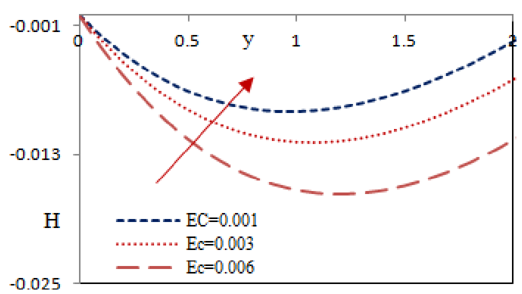
"**Figure 1(a):** Induced-magnetic profile of M
Pr = 0.71, Prm= 0.1, Gr = 5, Ec = 0.001,Q = 0.1"



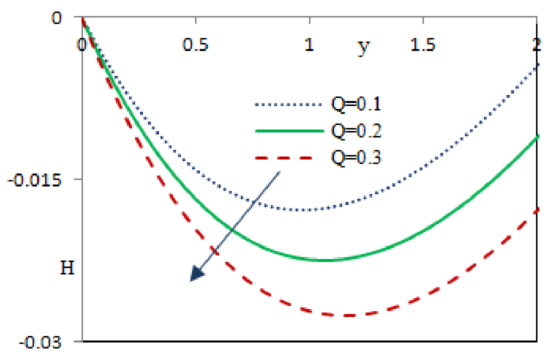
"**Figure 1(b):** Induced-magnetic profile of Prm
Pr = 0.71: Gr = 5.0:M= 0.25, Ec = 0.001,Q = 0.1 "



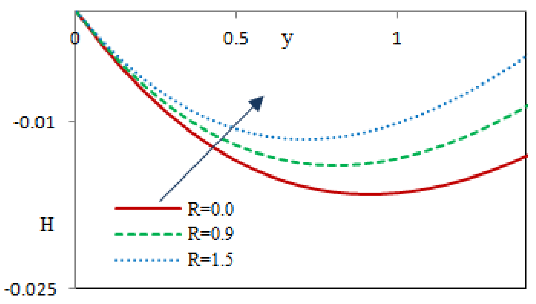
"**Figure 1(c):** Induced magnetic field profile of Pr
Prm = 0.1,:Gr = 5.0, M= 0.25, Ec = 0.001,Q = 0.1'"



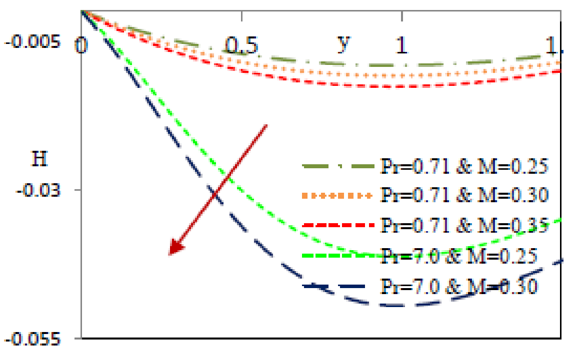
"**Figure 1(d):** Induced magnetic field profile for Pr = 0.71, Gr = 5,Prm =0.1,M= 0.25, Ec = 0.001,Q = 0.1".



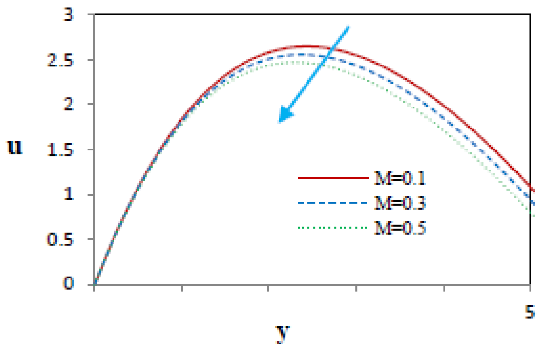
"**Figure 1(e):** Induced magnetic profile of Q Pr = 0.71, Gr = 5.0, M= 0.25, Ec=0.001,Prm = 0.1".



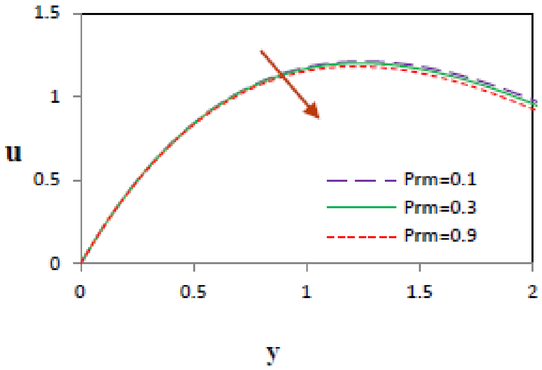
"**Figure 1(f):** Induced magnetic profile of R Pr=0.71:Gr=5.0:M=0.25,Ec=0.001,Q=0.1,Prm=0.1".



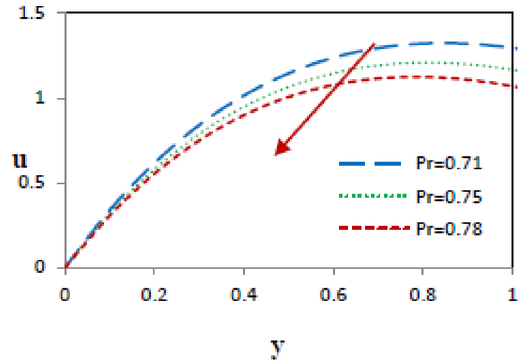
"**Figure 1(g):** Induced magnetic profile for Pr&M: Gr = 5.0, Ec = 0.001:Q = 0.1,Prm=0.1".



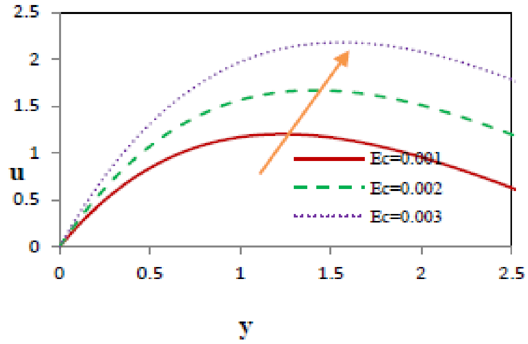
"**Figure 2(a):** Velocity profile of M, Gr = 5.0, Ec = 0.001, Q = 0.1:Prm=0.1: Pr=0.71".



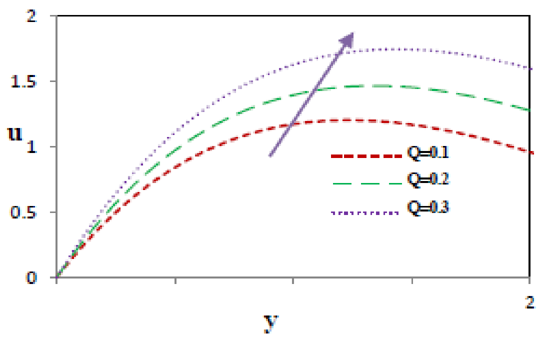
"**Figure 2(b):** Velocity profile for Prm when, Gr = 5.0, Ec = 0.001' Q = 0.1,Pr=0.71".



"**Figure 2(c):** Velocity profile for Pr when, Gr = 5.0, Ec = 0.001:Q = 0.1,Prm=0.1".



"**Figure 2(d):** Velocity profile for Ec when, Gr = 5.0, Ec = 0.001' Q = 0.1,Pr=0.71".



"**Figure 2(e):** Velocity profile for Q when, Gr = 5.0, Ec = 0.001' Prm = 0.1: Pr=0.71".

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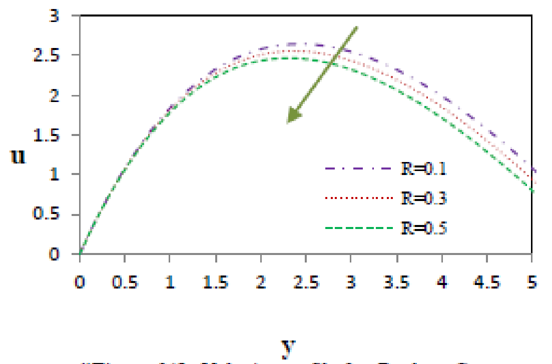
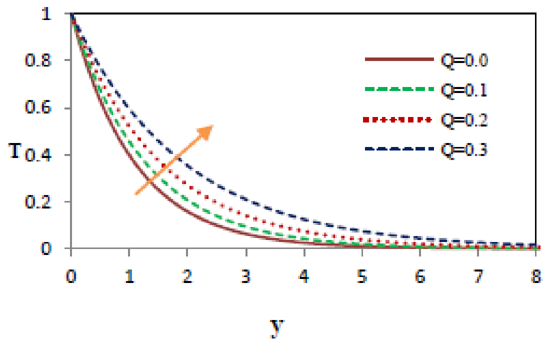
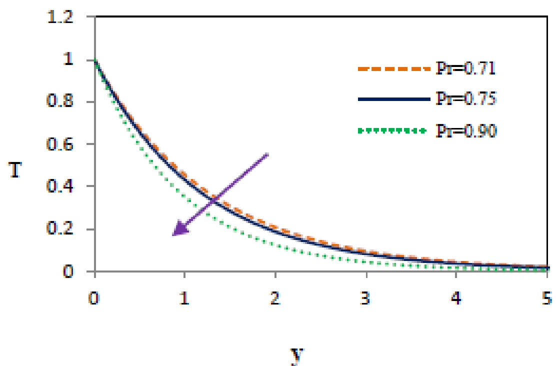


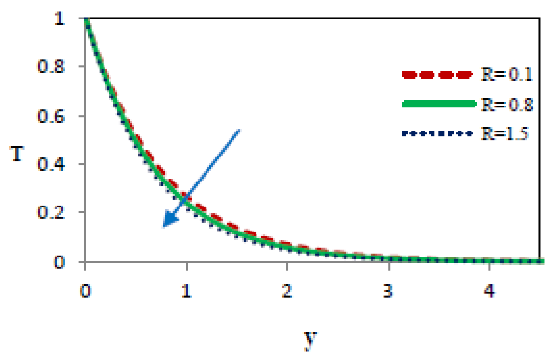
"Figure 2(f): Velocity profile for R when, Gr = 5.0. 'Ec = 0.001' O = 0.1.Pr=0.71.Prm=0.1"..



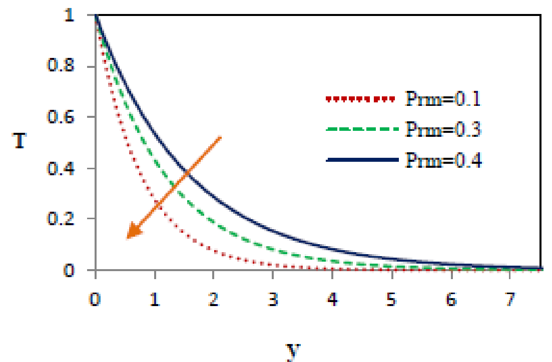
"Figure 3(a): Temperature profile for Q when Gr = 5.0, Ec = 0.001, 'Prm = 0.1',Pr=0.71,R=0.1".



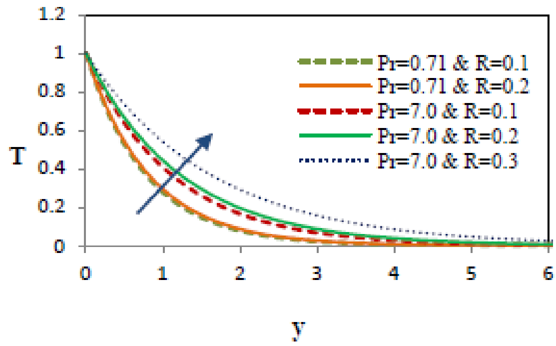
"Figure 3(b): Temperature for Pr when Gr = 5.0: Ec = 0.001, Prm = 0.1,R=0.1".



"Figure 3(c): Temperature profile for R when Gr = 5.0, Ec = 0.001, Prm = 0.1,Pr=0.71".



"Figure 3(d): 'Temperature profile for R when 'Gr=5.0,Ec=0.001'Prm=0.1,Pr=0.71".



"Figure 3(e): 'Temperature 'for Pr&R when, Gr = 5.0, Ec = 0.001, Prm = 0.1".

V. CONCLUSION

A conceptual inspection is performed to study the induced magnetic field influence on unconfined conduction of dissipative and radiative stream passed through a erect laminate with heat source and Temperature gradient. Galerkin procedure is applied to resolve coupled non-linear differential equations. Consequence of flow parameters 'Eckert number (Ec)' & 'Prandtl number (Pr)', 'Radiation (R)', 'Heat source (Q)', 'Magnetic Prandtl number (Prm)', Grashof number (Gr) on Induced magnetic profile, Velocity as well as Temperature are talk about via graphs.

Diminish in velocity when 'magnetic field parameter (M)' increases for air (Pr = 0.71) along with water (Pr = 7.0).

- Fall in 'Induced magnetic field (H)' as Magnetic field (M), Heat source (Q), and 'Magnetic field parameter (Prm)' raises.
- It is observed that induced magnetic field (H) rises as the Radiation (R), 'Eckert number (Ec) with Prandtl number (Pr)' increases.
- As the 'Radiation (R)' raises there is a fall in velocity. Since the stream execute a small reaction of radiation with moment border line layer.
- It is found that Velocity Accelerates as heat source (Q), and Eckert number (Ec) parameters increases.

- Velocity diminishes as the 'Magnetic Prandtl number (Prm)' become greater.
- Enlarge in Prandtl number (Pr), 'Radiation (R), along with Magnetic Prandtl number (Prm)' leads to fall in temperature.
- Temperature raises as the' Heat source (Q)' increases. Growth in Radiation (R), Temperature increases for water ('Pr = 7.0') as well s air ('Pr=0.71').

REFERENCES

1. Raptis A., Singh A.K., and Rai K.D. Unstable convective stream of a permeable of an adjacent to an semi-infinite erect laminate using difference scheme, Mer.res.comm,14, 9- 16.
2. Chen Ch heat along with mass change on a MHD stream by a Natural convection through a Permeable slant exterior with varying concentration and temperature. 'Acta Mech172:219-235 (2004).'
3. V. Ravikumar, Raju M.C. & A.J. Chamkha twice diffusive along with chemical reactive of MHD stream through a penetrable medium surrounded by double vertical plates. 'International journal energy technology 2013: 5(4) : 1 – 8.'
4. M.C. Raju, S.V.K Varma. Ananda Reddy, N. Emission and mass transfer impact on an unconfined convection stream over an porous medium bounded by a erect surface. 'Future Engineering and Technology Journal, 7 (2), pp.7-12 (2012).'
5. Kim Young J. unstable MHD convective heat change passed through an porous semi-infinite erect porous plate with suction changeable. Int. journal of engineering science 2000: 38: 833 – 45.
6. HS. Takhar, A. J. Chamkha and G. Nath heat along with mass transfer of a unsteady stream on a semi- infinite falt laminate with an aligned magnetic force of field. 'International journal of engineering science 1999: 37: 1723 – 36.'
7. Siddiqal S, Hossian MA. Mixed convection border line layer stream through an level erect plate with emission heat change. Applied Maths 2012: 3:705-16.
8. Ahmed Sahin, unconfined along with forced convective MHD Oscillatory stream through an infinite porous outside in unconfined stream which is oscillatory. 'Latin American Applied Research (2010) ,40,pp. 167-173.'
9. Raju M.C., S.V.K. Varma and Seshaiah B. effect of heat change on a viscous destructive fluid stream passed through a erect laminate in existence of induced magnetic field. 'Ains Shams Eng J 2015: 6, 333-339.'
10. K. Bhattacharyya, Mukhopadhya S, along with Layek GC. Similarity solution of mixed convection borderline layer slips stream over a erect laminate. 'Ain Shams Eng J 2013: 4(2):299- 305.'
11. Ravi Kumar V, Raju MC and Gss Nath. of combined heat inclusion along with MHD on convective Rivlin-Ericksen stream passed over a semi-infinite erect penetrable plate with varying suction along with temperature. 'Ain Shams Eng J 2014: 5(3):867- 75. '
12. Raju KVS, SudhakarReddy T., M. C. Raju, Satyanarayana PV, along with Venkataramana S. MHD convection stream over a penetrable medium in a level channel with an insulated and impermeable bottom wall in existence of viscous destructive along with Joule heating. 'Ain Shams Eng J 2014: 5(2):543- 51.'
13. A. A. Raptis, along with V.M . Soundalgekar, stable laminar convection stream of an electrically conducting liquid through a penetrable hot erect laminate in existence of heat source. 'ZAMM 64 (1984) 127-130.'
14. A.J.Chamkha, thermal emission along with buoyancy consequence on hydrodynamic stream through an accelerated permeable outside along with heat source and sink. 'International J. Engineering Science 38 (15) 2000 1699-1712.'
15. A.J. Chamkha along with C. Issa, consequence of heat inclusion or emulsion along with thermophoresis on hydro magnetic liquid with heat and mass change over a level surface . 'International journal Numerical Methods heat fluid flow 10 (2000) 432-448.'
16. A.J.Chamkha, MHD stream of a uniformly erect penetrable exterior in existence of chemical reaction along with heat inclusion or exclusion. 'Int. communication of heat and Mass transfer (30) (2003) 413-422.'
17. Savic L J, along with Steinruck H. Mixed convection stream passed through a level laminate. 'Theoret Apple Mech 2005: 32 (1):1-19.'
18. J.Prakash, along with A.G. Vijay Kumar, Rishi Kumar, and Varma S.V.K, consequence of emission along with induced magnetic force of field on MHD mixed convection stream through a erect penetrable laminate in existence of viscous along with magnetic dissipation. 'International conference on advances in marine, industrial and Mechanical engineering.(ICAMIME 2014) April 15-16, 2014, Johannesburg (south Africa).'
19. Raptis A.A. along with Soundalgekar, V.M, MHD liquid stream passed through a steadily moving unbounded erect penetrable plate along with heat flux constant. 'Nuclear Engineering and Design, volume 72 No. 3, pp.373-379. (1982).'
20. England, W.G. along with Emery, A.F.: thermal emission consequence on an unconfined laminar convection border line layer of inclusion gas. 'J. of Heat transfer, Volume 91, pp. 37- 44 (1969). '
21. M.C.Raju, S.V.K.Varma, along with B. Seshaiah Heat change consequence on a viscous destructive fluid stream past a laminate plate in existence of induced magnetic field. 'Ain Shams Engineering Journal (2015) 6, 333-339.'

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