International Journal of Research in Social Sciences
Vol. 7 Issue 12, December 2017,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

ON RICCI QUARTER SYMMETRIC METRIC CONNECTION IN A RIEMANNIAN MANIFOLD

N.V.C. SHUKLA*
RAM ASRAY VERMA*

ABSTRACT: In the present paper we have studied the some curvature tensor of ricci quarter symmetric metric connection in this paper we deal with Einstein manifold admitting the Ricci quarter-symmetric metric connection.Also we have studied the manifold of constant curvature.

KEYWORDS: Ricci quarter symmetric, Einstein manifold, ,m-Projective curvature,Pseudo Projective curvature tensor,constant curvature tensor.

MSC: [2010]52A20, 53B10

* Department of Mathematics & Astronomy, University of Lucknow
Lucknow, 226007, UP INDIA

INTRODUCTION

In 1975, Golab [7] introduced the idea of quarter-symmetric metric. Further,many authors had been about the various types of quarter symmetric metric connection and their characteristics in ([3].[4],[5],[8]) in 1980 Mishra and Pandey [6] gave the notation of Ricci quarter symmetric metric connection. In 1995, Kamilya and De [1] studied the Ricci quarter symmetric metric connection on a Riemannian manifold. Earlier in 2011, Yasar also studied the Ricci quarter symmetric connection on light like sub-manifolds in semi-Riemannian manifold [2].

A linear connection $\tilde{\nabla}$ in a Riemannian manifold M^n is said to be Ricci quarter symmetric metric connection if the torsion tensor T defined as

$$T(X,Y)=\pi(Y)LX-\pi(X)LY \quad (1.1)$$

Where π is a 1-form and L is the (1,1) Ricci tensor defined by

$$g(LX,Y)=S(X,Y) \quad (1.2)$$

S is the Ricci tensor of M^n

A linear connection $\tilde{\nabla}$ is called metric connection if

$$\nabla g(Y,Z)=0 \quad (1.3)$$

Other wiseit is known as Ricci quarter symmetric non metric connection .

For any vector field X and Y on M^n

If ∇ is Levi-Civita connection of the manifold then a ricci quarter symmetric metric connection is Given by [1]

$$\tilde{\nabla}_X Y=\nabla_X(Y)LX-S(X,Y)\rho \quad (1.4)$$

Where ρ is the vector field

$$\pi(X)=g(X,\rho) \quad (1.5)$$

In this paper we deal with an Einstein manifold admitting the quarter symmetric metric connection . After the Introduction , we have the brief introduction of the Einstein manifold admitting the ricci quarter symmetric metric connection in Preliminaries. In section 3, we have studied the m-projective curvature curvature tensor on admitting the ricci quarter symmetric metric connection. In section 4, we have studied the Psuedo projective curvature curvature tensor on admitting the ricci quarter symmetric metric connection. some other curvature tensor studied in last section.

PRELIMINARIES

Let M^n be an n-dimensional Riemannian manifold with Riemannian metric g, is said to to be an Einstein manifold. if its ricci tensor S of type (0,2)is of the form

$S(X,Y)=\frac{r}{n}g(X,Y),$ (2.1)

Where r is the scalar curvature .

Let $\tilde{R}$ be the curvature tensor of the connection $\tilde{\nabla}$ on the ricci quarter symmetric metric connection of Einstein manifold .It also satisfies

$\tilde{R}(X,Y)Z = R(X,Y)Z-\frac{r}{n}[M(Y,Z)X-M(X,Z)Y]$

$-\frac{r}{n}[g(Y,Z)QX-g(X,Z)QY],$ (2.2)

$\tilde{S}(X,Y)=\frac{r}{n}[g(Y,Z)-\{(n-2)M(Y,Z)+mg(Y,Z)\}],$ (2.3)

$\tilde{r}=\frac{r}{n}[n-2(n-1)m],$ (2.4)

$\tilde{S}(Y,Z)-\tilde{S}(Z,Y) = 0$ (2.5)

$\Leftrightarrow M(Z,Y)-M(Y,Z)=0$

$\tilde{R}(X,Y)Z+\tilde{R}(Y,Z)X+\tilde{R}(Z,X)Y = 0$ (2.6)

$\Leftrightarrow M(Z,Y)-M(Y,Z)=0,$

Where M is a tensor of type (0,2) defined by

$M(X,Y) = g(QX,Y)$ (2.7)

$= (\nabla\pi)(Y)-\pi(Y)\pi(LX)(1/2)\pi(\rho)S(X,Y),$

Where Q is vector field defined by

$QX=\nabla\rho-\pi(LX)\rho+(1/2)\pi(\rho)LX$ (2.8)

$\tilde{S}$is the ricci tensor of $\tilde{\nabla}$,$\tilde{r}$ is the scalar curvature of $\tilde{\nabla}$ and m is the trace of the tensor M(Y,Z).

An Einstein manifold $M^n(n>3)$ admits a ricci quarter symmetric metric connection is the manifold of constant curvature if the curvature tensor ´R is of the form

$'\tilde{R}(X,Y,Z,U) = K[g(Y,Z)g(X,U)-g(X,Z)g(Y,U)]$

$+\frac{r}{n}[M(Y,Z)g(X,U)-M(X,Z)g(Y,U)]$

$+\frac{r}{n}g(Y,Z)M(X,U)-g(X,Z)M(Y,U)]$ (2.9)

$'\tilde{S}(Y,Z)=K(n-1)g(Y,Z)+\frac{r}{n}[(n-2)M(Y,Z)+g(Y,Z)]$ (2.10)

$'\tilde{r}=Kn(n-1)g(Y,Z)+\frac{r}{n}2(n-2)m$ (2.11) m*-PROJECTIVE CURVATURE TENSOR

Definition ; Let M^n be n-dimensional Einstein manifold then the m*-projective curvature curvature tensor of M^n with respect ∇ is defined by [9],

$$w^*(X,Y,Z)=R(X,Y)Z -\frac{1}{2(n-1)}S(Y,Z)X-S(X,Z)Y]$$

$$-\frac{1}{2(n-1)}[g(Y,Z)LX-g(X,Z)LY]. \qquad (3.1)$$

Definition; Let M^n be n-dimensional Einstein manifold with quarter symmetric metric connection ∇ ,then the m*-projective curvature tensor of M^n with respect to the ricci quarter symmetric metric connection $\tilde{\nabla}$ is defined by [9],

$$\widetilde{w}*(X,Y,Z)=\tilde{R}(X,Y)Z -\frac{1}{(n-1)}[\tilde{S}(Y,Z)X-\tilde{S}(X,Z)Y]$$

$$-\frac{1}{(n-1)}[g(Y,Z)\tilde{L}X-g(X,Z)\tilde{L}Y]. \qquad (3.2)$$

Interchanging X,Y and Z in (3.2)

$$\widetilde{w}*(X,Y,Z)+\widetilde{w}*(Y,Z)X+\widetilde{w}*(Z,X)Y=0 \qquad (3.3)$$

If and only if M(Y,Z) is symmetric. Hence we have the theorem

Theorem ; In an n-dimensional Einstein manifold M^n with ricci quarter symmetric metric connection$\tilde{\nabla}$ a necessary and sufficient condition that the m*-projective curvature tensor of M^n with respect to the ricci quarter symmetric metric connection $\tilde{\nabla}$ to be cyclic is that the tensor M is symmetric.

Again by using (2.2)(2.3)(3.1) and (3.2) we get

$$\widetilde{w}*(X,Y,Z,U)=\widetilde{w}*(X,Y,Z,U) \qquad (3.4)$$

$$-\frac{n}{2(n-1)}[M(Y,Z)S(X,U)+M(X,Z)S(Y,U)+M(X,U)S(Y,Z)+M(Y,U)S(X,Z)]$$

$$-\frac{m}{2(n-1)}[g(Y,Z)S(X,U)+g(X,Z)S(Y,U)+g(X,U)S(Y,Z)+g(Y,U)S(X,Z)].$$

If S=0

$$\widetilde{w}*(X,Y,Z,U)=\widetilde{w}*(X,Y,Z,U) \qquad (3.5)$$

Hence we have

Theorem ; If the ricci tensor of the Einstein manifold admitting the quarter symmetric metric connection is vanishes then m*-projective curvature tensor of the Einstein manifold with ricci quarter symmetric metric connection is equal to curvature tensor of that manifold.

for Einstein manifold M^n (n>3)of constant curvature admits a ricci quarter symmetric metric connection , we have

Corollary;An Einstein manifold M^n (n>3) admits a ricci quarter symmetric metric connection is the manifold of constant curvature if the curvature tensor ′R is the form of (2.9)we have the following relation;

$'\widetilde{R}$(X,Y,Z,U)=-$'\widetilde{R}$(Y,X,Z,U)

$'\widetilde{R}$ (X,Y,Z,U)=-$'\widetilde{R}$(X,Y,U,Z)

$'\widetilde{R}$ (X,Y,Z,U)=-$'\widetilde{R}$(Z,U,X,Y)⇔M(X,Y)=M(Y,X)

From (2.9),(2.10) and (3.2)

$\widetilde{w*}$(X,Y,Z,U) = K[g(Y,Z)g(X,U)-g(X,Z)g(Y,U)] (3.2)

$+\frac{r}{n}$[M(Y,Z)g(X,U)-M(X,Z)g(Y,U)]

$+\frac{r}{n}$[g(Y,Z)M(X,U)-g(X,Z)M(Y,U)]

$-\frac{1}{2(n-1)}$[K(n-1)g(Y,Z)g(X,U)

$+\frac{r}{n}${(n-2)M(Y,Z)g(X,U)+mg(Y,Z)g(X,U)}

-K(n-1)g(X,Z)g(Y,U) $-\frac{r}{n}${(n-2)M(X,Z)g(Y,U)+mg(X,Z)g(Y,U)}

+K(n-1)g(X,U)g(Y,Z)

$+\frac{r}{n}${(n-2)M(X,U)g(Y,Z)+mg(X,U)g(Y,Z)}

-K(n-1)g(Y,U)g(X,Z)$-\frac{r}{n}${(n-2)M(Y,U)g(X,Z)+mg(Y,U)g(X,Z)}]

From (3.2),(3.6) and corollary, we can state the following theorem;

Theorem ; If Einstein manifold M^n(n>3)admits a ricci quarter symmetric metric connection is the manifold of constant curvature then m*- projective curvature tensor of M^n with respect to $\tilde{\nabla}$ satisfies the following

1. $\widetilde{w*}$(X,Y,Z,U)=-$\widetilde{w*}$(Y,X,Z,U)
2. $\widetilde{w*}$ (X,Y,Z,U)=$\widetilde{w*}$(X,Y,U,Z)
3. $\widetilde{w*}$ (X,Y,Z,U)-$\widetilde{w*}$(Z,U,X,Y)=0

⇔M(X,Y)=M(Y,X)

PSEUDO PROJECTIVE TENSOR

Definition ; Let M^n be n-dimensional Einstein manifold admitting ricci quarter symmetric metric connection then the pseudo-projective curvature curvature tensor of M^n with respect $\tilde{\nabla}$ is defined by ,

$\tilde{P}$(X,Y)Z = a$\tilde{R}$(X,Y)Z+b[$\tilde{S}$(Y,Z)X-$\tilde{S}$(X,Z)Y]-$\frac{\tilde{r}}{n}\{\frac{a}{n-1}$+b}[g(Y,Z)X-g(X,Z)Y].

From(2.2),(2.3),(2.4),(2.5),(2.6) and (4.01), we have

$\tilde{P}$(X,Y,Z)+$\tilde{P}$(Y,Z,X)+$\tilde{P}$(Z,X,Y)=0 (4.2)

⇔M(Y,Z)=M(Z,Y)

We have the following theorem:

Theorem ; In an n-dimensional Einstein manifold M^n with ricci quarter symmetric metric connection $\tilde{\nabla}$ a necessary and sufficient condition that the Pseudo-projective curvature tensor of M^n with respect to the ricci quarter symmetric metric connection $\tilde{\nabla}$ to be cyclic is that the tensor M is symmetric.

taking inner product with U and interchanging X and Y in (4.01), we get.**Theorem ;** If Einstein manifold M^n(n>3)admits a ricci quarter symmetric metric connection is the manifold of constant curvature then pseudo- projective curvature tensor of M^n with respect to $\tilde{\nabla}$ satisfies the following

1. $\tilde{P}$(X,Y,Z,U)=-$\tilde{P}$(Y,X,Z,U)
2. $\tilde{P}$(X,Y,Z,U)=$\tilde{P}$(X,Y,U,Z)
3. $\tilde{P}$(X,Y,Z,U)-$\tilde{P}$(Z,U,X,Y)=0

⇔M(X,Y)=M(Y,X)

CONCIRCULAR CURVATURE TENSOR

Definition ; Let M^n be n-dimensional Einstein manifold admitting ricci quarter symmetric metric connection then the concircular curvature tensor of M^n with respect $\tilde{\nabla}$ is defined by ,

$\tilde{Z}$(X,Y)U=$\tilde{R}$(X,Y)U-$\frac{\tilde{r}}{n(n-1)}$[g(Y,U)X-g(X,U)Y]. (5.1)

From(2.2),(2.4) and (5.1), we have

$\tilde{Z}$(X,Y)U = R(X,Y)U-$\frac{r}{n}$ [M(Y,U)X-M(X,U)Y+g(Y,U)QX-g(X,U)QY]

-$\frac{r}{n}$[$\frac{n-2(n-1)m}{n(n-1)}$\{g(Y,U)X-g(X,U)Y\}](5.2)

Interchanging X andY in (5.2), we have

$\tilde{Z}$(X,Y)U+$\tilde{Z}$(Y.X)U=R(X,Y)U+R(Y,X)U

Hence we state the following theorem

Theorem ; In an n-dimensional Einstein manifold M^n with ricci quarter symmetric metric connection $\tilde{\nabla}$ a necessary and sufficient condition that the concircular curvature tensor of M^n with respect to the ricci quarter symmetric metric connection $\tilde{\nabla}$ to be symmetric with respect to Xand Y is that curvature tensor of Einstein manifold is symmetric with respect to metric connection∇ in Xand Y.

From (5.01),(5.02).and interchanging the X,Yand we get

$\tilde{Z}$(X,Y,U)+$\tilde{Z}$(Y,U,X)+$\tilde{Z}$(U,X,Y)=0

$\Leftrightarrow$M(Y,U)=M(U,Y)

We have the following theorem:

Theorem ; In an n-dimensional Einstein manifold M^n with ricci quarter symmetric metric connection ∇ a necessary and sufficient condition that the Concircular curvature tensor of M^n with respect to the ricci quarter symmetric metric connection ∇ to be cyclic is that the tensor M is symmetric.

For constant curvature , by using (2.9)(2.10) and (5.01) we have

$$\tilde{Z}(X,Y,U,V) = \frac{r}{n}[\frac{2m}{n}g(U,X)g(V,Y)-g(U,Y)g(V,X)\}]$$

$$+\frac{r}{n}[M(V,X)g(U,Y)-M(U,X)g(V,Y)]$$

$$+\frac{r}{n}[M(U,Y)g(V,X)-M(V,Y)g(U,X)] \qquad (5.3)$$

From the (5.3) we have following statement

Theorem ; If Einstein manifold $M^n(n>3)$admits a ricci quarter symmetric metric connection is the manifold of constant curvature then concircular curvature tensor of M^n with respect to $\tilde{\nabla}$ satisfies the following

1. $\tilde{Z}$(X,Y,U,V)=-$\tilde{Z}$(Y,X,U,V)
2. $\tilde{Z}$(X,Y,V,U)=$\tilde{Z}$(X,Y,U,V)
3. $\tilde{Z}$(X,Y,U,V)-$\tilde{Z}$(U,V,X,Y)=0

$\Leftrightarrow$M(X,Y)=M(Y,X)

Again from (5.3),if

$\tilde{Z}$=0 ,$\tilde{r}$=0

and we state

Corollary;Let $M^n(n>3)$ be an Einstein manifold admits a ricci quarter symmetric metric connection is the manifold of constant curvature. If concircular curvature tensor of M^n with respect to $\tilde{\nabla}$ is vanishes then scalar curvature tensor is also vanishes.

CONHARMONIC CURVATURE TENSOR

Definition ; Let M^n be n-dimensional Einstein manifold then the conharmonic curvature tensor of M^n with respect ∇ is defined by ,

$$V(X,Y,Z,U) = R(X,Y,Z,U) \quad (6.1)$$
$$-\frac{1}{(n-1)}[S(Y,Z)g(X,U)-S(X,Z)g(Y,U)]$$
$$-\frac{1}{(n-1)}[S(X,U)g(Y,Z)-S(Y,U)g(X,Z)]$$

Definition ; Let M^n be n-dimensional Einstein manifold admitting the ricci quarter symmetric metric connection then the conharmonic curvature tensor of M^n with respect $\tilde{\nabla}$ is defined by

$$\tilde{V}(X,Y,Z,U) = \tilde{R}(X,Y,Z,U) \quad (6.2)$$
$$-\frac{1}{n-1}[\tilde{S}(Y,Z)g(X,U)-\tilde{S}(X,Z)g(Y,U)]$$
$$-\frac{1}{n-1}[\tilde{S}(X,U)g(Y,Z)-\tilde{S}(Y,U)g(X,Z)].$$

From(2.2),(2.3)(6.1) and (6.2), we have

$$\tilde{V}(X,Y,Z,U) = V(X,Y,Z,U) \quad (6.3)$$
$$-\frac{2rm}{n(n-2)}[g(X,Z)g(Y,U)-g(Y,Z)g(X,U)]$$

put $X=U=e_i$in (6.3), and taking the sum for$1\leq i\leq n$ we have we get

$$\tilde{S}(Y,Z)=S(Y,Z)+\frac{2rm}{n}g(Y,Z) \quad (6.4)$$

Hence we state the following theorem

Theorem ; Let M^n be n-dimensional Einstein manifold admitting the ricci quarter symmetric metric connection then the conharmonic curvature tensor of M^n with respect to $\tilde{\nabla}$ is vanishes then Ricci tensor of conharmonic curvature tensor of M^n is in the form of

$$\tilde{S}(Y,Z)=S(Y,Z)+\frac{2rm}{n}g(Y,Z). \quad (6.5)$$

if S=0, then from (6.2)

$\tilde{V}(X,Y,Z,U)=R(X,Y,Z,U)$

if r=0, then from (6.3)

$\tilde{V}(X,Y,Z,U)=V(X,Y,Z,U)$

Corollary;If the ricci tensor of the Einstein manifold admitting the ricci quarter symmetric metric connection is vanishes then conharmonic curvature tensor of the Einstein manifold with ricci quarter symmetric metric connection is equal to curvature tensor of that manifold

Corollary;If the scalar curvature tensor of the Einstein manifold is vanishes then conharmonic curvature tensor of the Einstein manifold with ricci quarter symmetric metric connection is equal to conharmonic curvature tensor of the Einstein manifold.

Let $M^n(n>3)$ be Einstein manifold of constant curvature admits a ricci quarter symmetric metric connection. by using (2.9) and (2.10) we define the conharmonic curvature tensor of

$\tilde{V}$(X,Y,Z,U) = K[g(Y,Z)g(X,U)-g(X,Z)g(Y,U)] (6.6)

$-\frac{Kn(n-1)}{n(n-2)}$[M(Y,Z)g(X,U)-g(Y,Z)M(X,U)]

$-\frac{Kn(n-1)}{n(n-2)}$[M(X,Z)g(Y,U)-g(X,Z)M(Y,U)]

Theorem ; If Einstein manifold $M^n(n>3)$admitting the ricci quarter symmetric metric connection is the manifold of constant curvature then conharmonic curvature tensor of M^n with respect to ∇ satisfies the following

1. $\tilde{V}$(X,Y,Z,U)=-$\tilde{V}$(Y,X,Z,U)
2. $\tilde{V}$ (X,Y,Z,U)=$\tilde{V}$(X,Y,U,Z)
3. $\tilde{V}$(X,Y,Z,U)-$\tilde{V}$(Z,U,X,Y)=0.

PROJECTIVE CURVATURE TENSOR

Definition ; Let M^n be n-dimensional Einstein manifold admitting the ricci quarter symmetric metric connection then the Projective curvature tensor of M^n with respect ∇ is defined by

$\tilde{P}$(X,Y),Z = $\tilde{R}$(X,Y),Z (7.1)

$-\frac{1}{(n-1)}$[$\tilde{S}$(Y,Z)X-$\tilde{S}$(X,Z)Y]

From(2.2),(2.3)and(7.01) we have

$\tilde{P}$(X,Y),Z = P(X,Y),Z- $\frac{r}{n}$ [M(X,Z)g(Y,U)-g(X,Z)M(Y,U) (7.2)

if r=0, then from (7.2)

$\tilde{P}$(X,Y),Z=P(X,Y),Z (7.3)

Corollary;If the scalar curvature tensor of the Einstein manifold admitting the ricci quarter symmetric metric connection is vanishes then projective curvature tensor of the Einstein manifold with ricci quarter symmetric metric connection is equal to projective curvature tensor of the Einstein manifold.

From (7.2)

$\tilde{P}$((X,Y,Z)+$\tilde{P}$((Y,Z,X)+$\tilde{P}$((Z,X,Y)=0 (7.4)

⇔M(Y,Z)=M(Z,Y)

We have the following theorem:

Theorem ; In an n-dimensional Einstein manifold M^n with ricci quarter symmetric metric connection $\tilde{\nabla}$ a necessary and sufficient condition that the projective curvature tensor of M^n with respect to the ricci quarter symmetric metric connection $\tilde{\nabla}$ to be cyclic is that the tensor M is symmetric.

Let $M^n(n>3)$ be Einstein manifold of constant curvature admits a ricci quarter symmetric metric connection. by using (2.9) and (2.10) we define the projective curvature tensor of

$$\tilde{P}(X,Y,Z,U) = \frac{r}{n(n-1)}[M(Y,Z)g(X,U)-mg(Y,Z)g(X,U)] \quad (7.5)$$

$$+\frac{r}{n(n-1)}[M(X,Z)g(Y,U)-mg(X,Z)g(Y,U)]$$

$$+\frac{r}{n(n-1)}[(n-1)M(X,U)g(Y,Z)-(n-1)M(Y,U)g(X,Z)]$$

Theorem ; If Einstein manifold $M^n(n>3)$admitting the ricci quarter symmetric metric connection is the manifold of constant curvature then Projective curvature tensor of M^n with respect to ∇ satisfies the following

1. $\tilde{P}$(X,Y,Z,U)=-$\tilde{P}$(Y,X,Z,U
2. $\tilde{P}$(X,Y,Z,U)=$\tilde{P}$(X,Y,U,Z)

REFRENCES

1 :D.Kamilya and U.C. De, Some properties of a ricci quarter-symmetric metric connection in Reimannian manifold, Indian J. pure appl. Math., 26(1),(1995),23-43.

2 : E. Yasar, On lightlikesubmanifolds in semi Riemannian manifold with ricci quarter-symmetric metric connection, Int. Ele. J. Geometry, 4(2),(2011),155-167.

3 :J.Sengupta, and B. Biswas, , Quarter-symmetric non-metric connection on a Sasakian manifold, Bull. Cal. Math.Soc., 95(2),(2003),169-176.

4 :N.V.C.Shukla, and J.Jaiswal, A study of Some curvature tensor on trans-Sasakian manifolds admitting quarter-symmetric non-metric connection, Int. J.Sci.Res., 3(12),(2014),2639-44.

5 :N.V.C.Shukla, and J.Jaiswal, Some results on Kenmotsu manifolds admitting quarter-symmetric non-metric connection, J.Adv.Math., 10(3),(2015),3326-32.

6 : R.S. Mishra And S.N. Pandey, Tensor , N.S.34(1980)1-7

7 :S.Golab,, On semi-symmetric and quarter-symmetric linear connections, Tensor, N. S., 29,(1975),249-254.

8 :S.Mukhopadhyay, A. K.Ray, and B.Barua, , Some properties of a quarter-symmetric metric connection on a Riemannian manifold, Soochow J. of Math., 17(2),(1991),205

9 :N.V.C.Shukla, and A.C.Pandey, (2014) Some properties on semi-symmetric metric T-connection on sasakian Manifold J.A.M. 1946-1954.

10: N.V.C.Shukla, and R.A. Verma, (2015) some curvature properties of sp-sasakian manifold with quarter-symmetric metric connection journal of rajasthan academy of physical sciences 115-125.

11 : K. Yano,andT.Imai, , Quarter-symmetric metric connections and their curvature tensors,Tensor, N. S. 38,(1982),13-18.

12 : M.Ahmad, ,A. Srivastava, and A.Prakash, , Pseudo projectively flat almost pseudo Ricci-symmetric manifolds, International Journal of Mathematical Archive, 5(7),(2014),104-109,.

13 : R. S.Mishra, and S. N. Pandey, , On quarter-symmetric metric F-connections, Tensor, N. S.,34,(1980),1-7.

14 : S. C. Biswas, and U. C. De,, Quarter-symmetric metric connection in an SP-Sasakian manifold, Common.Fac.Sci. Univ. Ank. Al.,46,(1997),49.

15 : Y. B. Maralabhavi, and G. S.Shivaprasanna, ; On Pseudo-Projective Curvature Tensor in LP-Sasakian Manifolds,Int. Mathematical Forum, Vol. 7,2012,no.23,1121-1128.