

A NOTE ON (κ, μ) -CONTACT METRIC MANIFOLDS

SUNIL KUMAR YADAV¹ AND XIAOMIN CHEN²

ABSTRACT. The aim of this research article is to categorize (κ, μ) -contact metric manifolds that fulfill certain curvature restriction on \mathcal{Q}^b -curvature tensor, \mathcal{W}_2^b -curvature tensor, \mathcal{M}^b -projective curvature and \mathcal{W}_9^b -curvature tensor. Further, we prove that if the manifold gratifies these curvature conditions then it is either $N(\kappa)$ -contact metric manifold or locally isometric to a Sasakian manifold of constant curvature 1. Finally, we provide an example for illustration.

Acknowledgment The second author is supported by Science Foundation of China University of Petroleum-Beijing (No.2462020XKJS02, No.2462020YXZZ004).

REFERENCES

- [1] E. Boeckx, *A full classification of contact metric (κ, μ) -spaces*, Illinois J. Math., **44** (2000), 212-219.
- [2] D. E. Blair, T. Koufogiorgos and B. J. Papantoniou, *Contact metric manifolds satisfying a nullity condition*, Israel J. of Math., **19** (1995), 189-214.
- [3] D. E. Blair, *Contact Manifolds in Riemannian Geometry*, Lecture Notes in Math., **509**, Springer-Verlag, (1976).
- [4] D. E. Blair, *Two remarks on contact metric structures*, Tohoku Math. J., **29** (1977), 319-324.
- [5] D. E. Blair and H. Chen, *A classification of 3-dimensional contact metric manifolds with $Q\varphi = \varphi Q$, II*, Bull. Inst. Math. Acad. Sinica, **20** (1992), 379-383.
- [6] U. C. De, Y. H. Kim and A. A. Shaikh, *Contact metric manifolds with ξ belong to the (κ, μ) -nullity distribution*, Indian J. Math., **47** (2005), 295-304.
- [7] U. C. De and S. Ghosh, *On quasi-conformal curvature tensor of (κ, μ) -contact manifolds*, Lobachevskii J. Math. **31**(2010), 367-375.
- [8] U. C. De and A. Sarkar, *On quasi-conformal curvature tensor of (κ, μ) -contact manifolds*, Math. Rep. (Bucur), **64**(2012), 115-129.
- [9] U. C. De, J. B. Jun and S. Samui, *Certain semisymmetry properties of (κ, μ) -contact manifolds*, Bull.Korean. Math. Soc. **53** (2012), 1237-1247.
- [10] S. Ghosh and U. C. De, *On a class of (κ, μ) -contact manifolds*, An. Univ. Oradea Fasc. Mat., **XIX**(2012), 231-242.
- [11] C. A. Mantica and Y. J. Suh, *Pseudo- Q -symmetric Riemannian manifolds*, Int. J. Geom. Methods Mod. Phys. **10**(5), (2013), 25 pages.
- [12] G. P. Pokhariyal and R. S. Mishra, *The curvature tensor and their relativistic significance*, Yokohama Math. J., **19** (1971), 97-103.
- [13] G. P. Pokhariyal, *Relativistic significance of curvature tensors*, Internat. J. Math. and Math. Sci. **5**, (1) (1982)
- [14] B. J. Papantoniou, *Contact manifolds, harmonic curvature tensor and (κ, μ) -nullity distribution*, Comment Math. Univ. Carolinne, **34**(1993), 323-334.
- [15] T. Tanno, *The topology of contact Riemannian-manifolds*, Illinois J. Math., **12** (1968), 700-717.
- [16] S. Tanno, *Ricci curvatures of contact Riemannian manifolds*, Tohoku Math. J., **40** (1988), 441-448.
- [17] A. Yildiz and U. C. De, *A classification of (κ, μ) -contact manifolds*, Commun. Korean Math. Soc., **27**(2012), 327-339.

2010 *Mathematics Subject Classification*. Primary 53C15, Secondary 53C25.

Key words and phrases. Contact metric manifolds, (κ, μ) -contact metric manifolds, \mathcal{Q}^b -curvature tensor, \mathcal{W}_2^b -curvature tensor, \mathcal{W}_9^b -curvature tensor, \mathcal{M}^b -projective curvature tensor.

- [18] A. Yildiz, J. B. Jun and U. C. De, *On φ -recurrent (κ, μ) -contact manifolds*, Bull. Korean Math. Soc., **45**(2008), 689-700.
- [19] A. Yildiz and C. Murathan, *Contact Riemannian manifolds satisfying $C(\xi, X) \cdot S=0$ and $\xi \in (\kappa, \mu)$ -nullity distribution*, Commun. Fac. Sci. Univ. Ank. Ser. A1. Math. Stat., **49**(2000), 33-37.

Received 8 February 2022

¹ DEPARTMENT OF APPLIED SCIENCE AND HUMANITIES, UNITED COLLEGE OF ENGINEERING & RESEARCH, A-36, UPSIDC, INDUSTRIAL AREA, NAINI, PRAYAGRAJ-211010, UTTAR PRADESH, INDIA. ORCID. No.0000-0002-0614-9354

² COLLEGE OF SCIENCE, CHINA UNIVERSITY OF PETROLEUM-BEIJING, BEIJING, 102249, CHINA. ORCID. No.0000-0002-0549-8906

Email address: ¹ prof_sky16@yahoo.com, ² xmchen@cup.edu.cn