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| **Title:** | R. M. Arnob, S. Nahar, **M. N. Uddin** | | | |
| **Author(s) Name:** | Design of high capacity 5.76 Tbits/s SDM-PDM-Nyquist superchannel WDM hybrid multiplexing in 3.1% Germania doped MMF | | | |
| **Contact Email(s):** | drnasir@aiub.edu | | | |
| **Published Journal Name:** | AIUB Journal of Science and Engineering (AJSE) | | | |
| **Type of Publication:** | Journal | | | |
| **Volume:** | 21 | | Issue | 3 |
| **Publisher:** | **ORP-AIUB** | | | |
| **Publication Date:** | 31st Dec. 2022 | | | |
| **ISSN:** | | p-ISSN 1608-3679, e-ISSN 2520-4890 | | |
| **DOI:** | [[10.53799/ajse.v21i3.373](http://dx.doi.org/10.53799/ajse.v21i3.373)](https://doi.org/10.53799/ajse.v21i2.378) | | | |
| **URL:** | <http://dx.doi.org/10.53799/ajse.v21i3.373> | | | |
| **Other Related Info.:** | Page 139-146 | | | |
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| **Abstract:** |  |
| **To dispatch the goal about walking towards the 4th Industrial Revolution, one of the main key materials that require alterations and enhancements is data communication and transmission. To keep up with the augmented rise in demand for data, fiber-optics communication and networks commence a significant role in the transfer of data at high speeds. This article exemplifies the expediency analysis of 5.76 Tbits/s SDM-PDM-Nyquist superchannel WDM hybrid multiplexing technique over a multimodal transmission link up to 10 km using C-band carrier frequencies. This system is designed to carry 48 channels of data that can be produced using 8 C-band carrier frequencies, 2 polarization states, and 3 LP modes through 3.1% Germania doped over pure silica step-index multimode fiber. The system exhibits a satisfactory performance (log BER -9.35, faithful Q-factor 6.09, extinction ratios 7.78, minimum OSNR 46.5 dB) up to a distance of 10 km. Each channel receives a satisfactory amount of power after the dual-stage amplification process in the transmission medium with an ultra-high spectral efficiency of 137% and a high bandwidth-distance product of 385 MHz.km** | |