

शोध परियोजना

परियोजना का शीर्षक

उत्तराखण्ड के ग्रामीण क्षेत्रों से हो रहे पलायन पर एक अध्ययन

परियोजना का परिचय आज उत्तराखण्ड राज्य के लिए पलायन एक बहुत बड़ी समस्या बन चुकी है यहां के ग्रामीण क्षेत्रों के युवा व पुरुष ही नहीं अपितु अब लड़कियां भी शिक्षा को ग्रहण करने के उपरान्त अपने गांवों से नौकरी की तलाश में मैदानी क्षेत्रों की ओर पलायन कर रहे हैं। यह पलायन दिन प्रतिदिन बढ़ता जा रहा है। जोकि इस राज्य के पहाडी जिलों के गांव खलियानों के लिए एक बहुत बड़ी समस्या बन रही है। इस समस्या को देखते हुए मौजूदा त्रिवेन्द्र सरकार ने 17 सितंबर 2017को राज्य में पहला पलायन अयोग तक का गठन कर दिया है। यहां ग्रामीण क्षेत्रों की अर्थव्यवस्था को मनीऑर्डर अर्थव्यवस्था के नाम से जाना जाता है। कई क्षेत्र अभी तक विकास की मुख्यधारा से बाहर हैं। खराब जीवन स्तर व आर्थिक स्थिति का ठीक ना होने के कारण यहां के पुरुष मैदानी क्षेत्रों में रोजगार हेतु जाते हैं परन्तु धीरे धीरे परिवार को भी अपने साथ ले गए हैं जिस कारण आज पहाड के गांव खाली हो चुके हैं। कुछ गावों में केवल वृद्ध लोग व महिलाएं ही हैं। पुरुषों के पलायन के कारण इन क्षेत्रों से जुडी सभी समस्याओं का बोझ यहां कि महिलाओं पर ही रहता है समाजिक व राजनीतिक क्षेत्र में अपनी भूमिका निभाने के बावजूद भी इस राज्य की ग्रामीण व पहाडी अर्थव्यवस्था में महत्वपूर्ण भूमिका भी महिलाओं की होती है।

आज उत्तराखण्ड राज्य को अस्तित्व में आये दो दशक हो गए हैं तब से निरंतर राज्य का पलायन बढ़ता ही जा रहा है पलायन आयोग की रिपोर्ट के अनुसार प्रदेश के हजारों गांव पूरी तरह खाली हो चुके हैं वहीं 400 से अधिक गांव ऐसे हैं जहां 10 से भी कम नागरिक हैं, इसलिए यह विषय अपने आप में शोध परियोजना के लिए रोचक दिखाई देता है। पलायन आयोग की ओर से सौंपी गई उत्तराखण्ड शासन को अपनी रिपोर्ट में अकेले अल्मोडा जिले में ही 70 हजार लोगों ने पलायन किया है राज्य की 646 पंचायतों के 16207 लोगों ने स्थाई रूप से अपना गांव छोड दिया है इसी रिपोर्ट में 73 फीसदी परिवारों की मासिक आय 5000 रुपये से कम बताई गई है। यह विषय अपने आप में बहुत प्रांसगिक है। खाली पडे गांवों को भूतिया गांव कहे जाने लगा है पलायन करने वालों में सर्वाधिक युवा वर्ग के हैं। पलायन आयोग के वर्तमान अध्यक्ष एस एस नगी का कहना है कि रोजगार के साधनों के अभाव ही युवाओं के पलायन का मुख्य कारण है रोजगार के नाम पर पहाडों पर कुछ भी नहीं है जिसके कारण युवा रोजी रोटी की तलाश में बडे शहरों का रूख करने को विवश हो रहे हैं यह परियोजना अपने अध्ययन में कौन कौन सी योजनाएं व उद्योग एवं नीति इन पहाडी क्षेत्रों के लिए उपयोगी साबित हो सकती हैं जिससे यहां का पलायन को रोका जा सके। व इस समस्या का समाधान के लिए अध्ययन करेगी। ओर इस राज्य में प्राकृतिक संसाधन तो प्रचुर मात्रा में है लेकिन मानवीय संसाधन को एक कोशल विकास के रूप में विकसित करने के लिए संभावित नए तथ्यों पर कार्य करेगी।

साहित्य की समीक्षा

उत्तराखण्ड में पलायन हर एक दिन बढ़ता जा रहा है ग्रामीण क्षेत्र से शहरी क्षेत्र की ओर पलायन आज से नहीं जब से उत्तराखण्ड अलग राज्य बना, आज 20 वर्षों के उपरान्त भी राज्य के ग्रामीण क्षेत्र के लोग दो जून की रोटी के लिए मैदानी क्षेत्रों में प्रवास कर रहे हैं। इस पर पत्र पत्रिकाओं में लेख तो काफी संख्या में उपलब्ध हैं लेकिन विस्तृत शोध अभी तक बहुत कम हुआ है इसलिए उत्तराखण्ड राज्य ने 2017 में पलायन आयोग का गठन किया। उत्तराखण्ड के पर्वतीय जनपदों से मूलभूत सुविधाओं के अभाव से लोग पलायन कर रहे हैं हैं। अकेला जनपद अल्मोडा में वर्ष 2001 से 2011 तक इन दस सालों में करीब 70 हजार लोग पैतृक गांव से पलायन कर गए यह उत्तराखण्ड पलायन आयोग की रिपोर्ट में कहा गया है। पर्यावरणविद अनिल जोशी भी मानते हैं कि भौगोलिक आधार पर परिसीमन होना चाहिए। वो अपनी रिपोर्ट में कहते कि उत्तराखण्ड का पलायन 1930 में शुरू हुआ था तब यह कम था मोहन लाल सुखडिया ने अपने शोध पत्र पलायन पर लिखा कि हमारे देश की ग्रामीण जनसंख्या का प्रतिशत निरंतर घट रहा है जिसके पीछे मुख्य कारण गांवों से शहरों की ओर पलायन है। गांवों में बुनियादी विकास मूल आवश्यकता है। हर जगह शिक्षा की अलख जगानी होगी। 2011 के अनुसार हमारे देश की कुल जनसंख्या 121.02 करोड़ आंकलित की गई थी जिसमें 68.84 प्रतिशत जनसंख्या गांवों में निवास करते हैं और 31.16 प्रतिशत जनसंख्या शहरों में निवास करती है। स्वतंत्र भारत की प्रथम जनगणना 1951 में ग्रामीण व शहरी आबादी का अनुपात 83 प्रतिशत एवं 17 प्रतिशत था। 50 वर्ष बाद 2001 की जनगणना में ग्रामीण एवं शहरी जनसंख्या का प्रतिशत 74 एवं 26 प्रतिशत हो गया। इन अध्ययन के आकड़ों के आधार पर यह स्पष्ट है कि भारतीय ग्रामीण लोगों का शहरों की ओर पलायन तेजी से बढ़ रहा है। इस संदर्भ में जैसा कि महात्मा गांधी के सत्याग्रह के विभिन्न प्रकारों में एक हिजरत था इसका अर्थ अपने स्थायी व परम्परागत निवास स्थान को स्वेच्छा से छोड़कर अन्य किसी इलाके में जाकर बस जाना कहा था। हिंदी के प्रसिद्ध कथाकार मुंशी प्रेमचन्द ने अपने प्रसिद्ध उपन्यास गोदान में लगभग 85 वर्ष पूर्व गांव छोड़कर शहर जाने की समस्या को उठाया था। अपनी मूलभूत आवश्यकताओं की पूर्ति करने का प्रयास करना पलायन कहलाता है। यह पलायन की प्रवृत्ति कई रूपों में देखी जा सकती है जैसे एक गांव से दूसरे गांव में, गांव से नगर, नगर से नगर, नगर से गांव। भारत में गांव से शहरों की ओर पलायन की प्रवृत्ति अधिक है पूर्व राष्ट्रपति एवं मिसाइल मैन डा अब्दुल कलाम ने भी कहा था कि शहरों को गांवों में ले जाकर ही ग्रामीण पलायन पर रोक लगाई जा सकती है।

राष्ट्रीय व अन्तर्राष्ट्रीय स्तर पर परियोजना की वैचारिक रूपरेखा

उत्तराखण्ड राज्य सामरिक दृष्टि से भी महत्वपूर्ण है यह राज्य दो देशों की सीमा से लगा हुआ है उत्तराखण्ड राज्य का पहाड़ी हिमालयी क्षेत्र की सीमा चीन तथा नेपाल राष्ट्र से लगा हुआ है। यदि इन पहाड़ी गांवों का पलायन रुकेगा नहीं तो वो दिन दूर नहीं जब ये गांव खाली हो जायेंगे जो राष्ट्र हित के लिए अच्छा संकेत नहीं है इसलिए भी यह अध्ययन सामरिक दृष्टि से भी बहुत महत्वपूर्ण हो जाता है यह परियोजना यह अध्ययन करेगा कि पलायन को रोकने के लिए क्या आवश्यक नीतियां यहां के लिए होनी चाहिए। यह क्षेत्र भारत

के उत्तर में स्थित हिमालय विश्व की नवीन व सर्वोच्च पर्वत श्रृंखला है, जो कि अतीत काल से ही भारतीयों की जिज्ञासा एवं प्रेरणा का स्रोत रहा है। अपने सौन्दर्य, रहस्यात्मक भव्यता और उच्चता से इस पर्वत श्रृंखला ने मानवीय कल्पनाएं और उदात्त अनुभूतियों का संचार किया है। वेदों और पुराणों में भी यहां के हिमालय की समस्त गौरव गाथा का उल्लेख मिलता है। पुराणों में वर्णन किया गया है कि मानसखण्ड एवं केदारखण्ड से मिलकर वर्तमान में उत्तराखण्ड राज्य बना है। यह गढ़वाल क्षेत्र तथा कुमायूँ क्षेत्र दो मण्डल मिलकर बना है

गढ़वाल मण्डल में सात जिले, देहरादून, टिहरी गढ़वाल, पौड़ी गढ़वाल, उत्तरकाशी, रुद्रप्रयाग, चमोली व हरिद्वार है तथा कुमायूँ मण्डल में छः जिले नैनीताल, अल्मोड़ा, पिथौरागढ़, बागेश्वर, चम्पावत एवं उधमसिंह नगर है। उत्तराखण्ड पृथक राज्य का निर्माण ही विकास व रोजगार के लिए हुआ था इस राज्य की भौगोलिक स्थिति में तेरह जिलों में से ग्यारह जिले पहाड़ी हैं व दो जिले मैदानी हैं। पहाड़ी ग्रामीण क्षेत्रों में शिक्षा की अच्छी स्थिति ना होना, बेरोजगारी व यातायात अस्पताल आदि की अच्छी स्थिति ना होने के कारण अधिकांश गांव के गांव खाली हो चुके हैं।

उत्तराखण्ड राज्य पहाड़ी ग्रामीण क्षेत्रों का प्रतीक है उत्तर प्रदेश राज्य से इसलिए अलग पृथक राज्य बना पहाड़ी जिलों के विकास के लिए। यहां प्राकृतिक सम्पदा भरपूर मात्रा में है लेकिन औद्योगिक विकास की कमी है, लघु एवं कुटीर उद्योगों की घोर लापरवाही ने बेरोजगारी की समस्या को और अधिक बढ़ा दिया है। उत्तराखण्ड राज्य के पहाड़ी ग्रामीण क्षेत्र कई समस्याओं का सामना करते हैं। इन क्षेत्रों के निवासियों की समस्या दुर्गमता से लेकर स्वास्थ्य, शिक्षा और यहां तक कि भोजन और पानी जैसी बुनियादी सुविधाओं तक है। उनके उत्पादों आदि के लिए ऋण व संसाधनों व बाजार के लिए दुर्गमता जो इन पहाड़ी क्षेत्रों के मूल निवासियों के लिए कठिन जीवन और कामकाजी दशा प्रस्तुत करती है। जिस कारण रोजगार हेतु यहां के युवाओं का भारी पलायन हुआ है। यह परियोजना अपने अध्ययन में निम्न उद्देश्यों पर कार्य करेगी।

प्रस्तावित शोध परियोजना के अध्ययन का उद्देश्य

- 1 पहाड़ी गांवों से पलायन होने के कारणों पर अध्ययन करना।
- 2 पहाड़ी क्षेत्रों में रोजगार के संभावनाओं को खोजना।
- 3 पहाड़ी क्षेत्रों में कृषि, उद्यान, कुटीर उद्योग, मत्स्य पालन, पशुपालन व उत्पादकों की बिक्री हेतु मंडी व्यवस्था की नई संभावनाओं की खोज करना।
- 4 सरकार द्वारा बनाई गयी गांवों के लिए योजनाओं का असफल होने के कारणों का अध्ययन करना।
- 5 पहाड़ के लिए कौन कौन सी योजनाएं होनी चाहिए जो धरातल पर लागू हो का अध्ययन करना।
- 6 युवाओं के लिए कौन सी योजना हो सकती है उसका अध्ययन करना

7 पहाड में पहाड जैसा जीवन जीने को मजबूर लोगों की समस्याएं समझने का प्रयास करना व उन लोगों के लिए गुणात्मक जीवन स्तर का अध्ययन करना।

8 पुरुषों के पलायन के कारण महिलाओं के जीवन में आर्थिक, सामाजिक व राजनीतिक स्थिति का अध्ययन करना।

9 कोरोना काल में वापस अपने गांवों की और आए कुशल कारीगरों पर अध्ययन करना।

10 रिवर्स पलायन कर आए लोगों के लिए क्या नीति हो सकती है जिससे वो वापस पलायन ना करें का अध्ययन करना।

परियोजना की शोध विधि एवं समय सीमा

शोध विधि एवं परिकल्पना किसी भी अनुसन्धान कार्य की आधारशिला है। यह आधारशिला जितनी सुदृढ़ होती है अनुसन्धान के परिणाम भी उतने ही विश्वसनीय एवं परिशुद्ध होते हैं। इस शोध परियोजना कार्य में आंकड़ों को एकत्रित करने के लिए सर्वेक्षण विधि का प्रयोग किया जाएगा जिसके लिए निदर्शन की आवश्यकता होगी। दैव निदर्शन विधि के माध्यम से विकासखण्ड व ग्राम पंचायतों एवं उत्तरदाताओं को अध्ययन के लिए चुना जाएगा। सर्वेक्षण हेतु समग्र व समविष्ट में से एक ऐसे अंश का चुनाव किया जाएगा जिसके आधार पर सम्पूर्ण या समग्र विषय के परिणाम निकाले जायेंगे। यद्यपि संकलित तथ्य जिनके आधार पर निष्कर्ष निकाले जायेंगे वे समग्र के केवल एक भाग से सम्बन्धित होते हैं। परन्तु इसमें समग्र में से चुनी गई इकाइयों का न्यायोचित एवं सर्वोत्तम प्रतिनिधित्व आ जाता है। इस उचित प्रतिनिधित्व को प्राप्त करने के लिए सामाजिक अनुसन्धान में अधिकांशतः दैव प्रतिदर्श पद्धति (**Simple Random Sampling**) का प्रयोग किया जाएगा। दैव प्रतिदर्श पद्धति वह पद्धति है, जिसमें समग्र की सभी इकाइयों को समान महत्व दिया जाता है तथा इकाइयों की चयन प्रक्रिया में उस समग्र की प्रत्येक इकाई के चयन की समान सम्भावना बनी रहती है।

न्यायदर्श का स्वरूप

इस दृष्टिकोण से प्रस्तुत अध्ययन के उद्देश्यों की पूर्ति के लिए उक्त परियोजनाकर्ता के द्वारा उत्तराखण्ड के दो मण्डल के एक- एक जनपद व एक जनपद के दो विकासखण्ड व एक विकासखण्ड के चार - चार गांवों को अध्ययन के लिए चयनित किया जाएगा। व एक ग्राम पंचायत से बीस उत्तरदाताओं को अध्ययन हेतु चयनित किया जाएगा। इस प्रकार से हमारे अध्ययन में कुल दो मण्डल व दो जिलों में से चार विकासखण्ड व सोलह ग्राम पंचायत तथा 320 उत्तरदाता होंगे। इन लोगों का साक्षात्कार, साक्षात्कार अनुसूची के आधार पर लिया जाएगा। प्रस्तुत शोध परियोजना में उत्तराखण्ड राज्य के गढ़वाल मण्डल के चमोली व कुमायूँ मण्डल के अल्मोडा जनपदों में पलायन के कारणों का सविस्तार अध्ययन किया जाएगा।

आंकड़ों का संकलन

वास्तव में आंकड़े ही वह मार्ग हैं, जिसकी सहायता से यह शोध परियोजना को एक विशिष्ट रूप प्राप्त हो सकता है। जितने तथ्यपरक आंकड़ों को संग्रहित किया जाता है, शोध

के निष्कर्ष भी उतने ही सारगर्भित होते हैं। इस शोध परियोजना में मौलिकता के आधार पर प्राथमिक एवं द्वितीयक दोनों प्रकार के आंकड़ों का प्रयोग किया जाएगा। प्राथमिक आंकड़ों के अन्तर्गत शोध परियोजना सर्वेक्षणकर्ता स्वयं घटना स्थल पर जाकर या सम्बन्धित व्यक्तियों से साक्षात्कार, प्रश्नावली एवं अनुसूची के द्वारा आंकड़ों को संग्रहित करेगा। जबकि द्वितीयक सामग्री में से हम पलायन से संबन्धी आंकड़े, प्रकाशित या अप्रकाशित प्रलेखों से एकत्र करेंगे। प्रस्तुत शोध परियोजना में निम्न प्रविधियों का प्रयोग करके आंकड़ों का संकलन किया जायेगा। प्रस्तुत शोध परियोजना के अन्तर्गत अनुसन्धानकर्ता द्वारा तथ्यों को एकत्र करने हेतु अनुसूची का प्रयोग किया जायेगा जिसमें अनेक प्रश्नों की एक लिखित सूची तैयार करके परियोजना फ़ैलो उत्तरदाता के पास स्वयं जाकर तथा उत्तरदाताओं से प्रत्यक्ष सम्पर्क स्थापित करके तथा विभिन्न प्रश्नों को पूछकर स्वयं उनके उत्तरों का आलेखन करेगा। चूंकि इसमें उत्तरदाताओं की भावनाओं, प्राथमिकताओं, मनोवृत्तियों, प्रवृत्तियों आदि का आंकलन आसानी से लगाया जाता है। अतः प्रश्नों को उत्तर उत्तरदाता के सम्मुख ही अनुसूची में भरे जायेंगे।

प्रस्तुत शोध परियोजना में साक्षात्कार अनुसूची का प्रयोग इसलिए भी किया जाएगा ताकि सम्बन्धित उत्तरदाताओं की वास्तविक सामाजिक-आर्थिक पृष्ठभूमि की जानकारी प्राप्त हो सके, तथा शोध परियोजना में अध्ययन के उद्देश्यों की पूर्ति के लिए उपयोगी सूचनाएं प्राप्त की जा सकें। साक्षात्कार अनुसूची का निर्माण करने से पूर्व उपलब्ध सम्बन्धित साहित्य का भी अध्ययन किया गया। प्रश्नों को सरल भाषा में एवं शोध परियोजना के उद्देश्यों को ध्यान में रखकर तथा कम समय में अध्ययन की दृष्टि से पर्याप्त उपयोगी जानकारी प्राप्त करने के उद्देश्य से बनाया जाएगा। प्रस्तुत अध्ययन में अनुसूची के अतिरिक्त अवलोकन विधि का प्रयोग भी किया गया है। यह शोध परियोजना के उद्देश्य की पूर्ति हेतु सहायक होगा। पलायन से सम्बन्धित अवलोकन करके तथ्य एकत्रित किए जाएंगे।

आंकड़ों का विश्लेषण

प्रस्तुत शोध परियोजना में आंकड़ों के विश्लेषण में पारम्परिक सांख्यिकीय विश्लेषण एवं एस. पी.एस.एस. पद्धति दोनों को प्रयोग में लाया जा सकता है। साधारण प्रतिशत की विधि को भी प्रयोग में लाया जाएगा। विश्लेषण में जिन मुख्य परिमाण प्रविधियों एवं सार्थकता परीक्षणों का प्रयोग किया जाएगा उन्हें टी व एनोवा टेस्ट सम्मिलित रहेंगे अध्ययन के अन्तर्गत विश्लेषण में उन स्वतन्त्र चरों जिनको मात्रात्मक मूल्यों में परिवर्तित करना सम्भव था उनको तुलना हेतु दो वर्गों में विभक्त किया जा सकता है। जैसे वैवाहिक स्थिति, पारिवारिक संरचना एवं स्थायी आवास की स्थिति आदि का मूल्यांकन टी टेस्ट द्वारा किया जाएगा तथा उन स्वतन्त्र चरों को जिनको तुलना हेतु दो से अधिक वर्गों में विभक्त किया गया था, जैसे आयु वर्ग, शैक्षिक स्थिति, जाति, व्यवसाय, मासिक आय व स्थायी आवास की सड़क से दूरी आदि का मूल्यांकन एनोवा द्वारा किया गया। जितने भी स्वतन्त्र चर थे उनकी तुलना मध्यमान के आधार पर की जाएगी तथा यह जानने का प्रयास किया गया कि ग्रामीण क्षेत्रों से किन लोगों ने अधिकांश शहरी क्षेत्र में पलायन किया है।

इस शोध परियोजना की फाइनल रिपोर्ट प्रस्तुत करते समय प्रकाशित एवं अप्रकाशित शोध ग्रन्थों, सरकारी दस्तावेजों, शोध पत्र-पत्रिकाओं, समाचार पत्रों, क्षेत्रीय साहित्य व उत्तराखण्ड

राज्य के पलायन आयोग द्वारा समय समय पर प्रकाशित रिपोर्टों व आंकड़ों, दस्तावेजों आदि व क्षेत्र से सम्बन्धित प्रकाशित साहित्य आदि से भी पर्याप्त सहायता ली गयी है।

शोध परियोजना की समय सीमा कुल चौबीस महिनें

छः (6) माह फील्ड सर्वेक्षण का कार्य।

छः (6) माह कोडिंग डिकोडिंग व आकड़ों का विश्लेषण।

तीन (3) माह द्वितीय स्रोत से आकड़ों को एकत्रित करना व सारणी बनाना।

नौ (9) माह फाइनल शोध परियोजना रिपोर्टिंग व प्रकाशन।

कोरोना के बाद स्कोप और कार्यप्रणाली

भारत के सन्दर्भ में कहा जाता था कि भारत गांवों का देश है वर्तमान में गांव के गांव शहरों में पलायन कर चुके हैं व दिन प्रतिदिन करते जा रहे हैं लेकिन विश्व महामारी कोरोना के आने के बाद इस सन्दर्भ से इस विषय पर शोध परियोजना का महत्व अपने आप में एक नया अभिनव कार्य है। चूंकि कोरोना संक्रमण के कारण केवल उत्तराखण्ड में ही नहीं अपितु सभी क्षेत्रों में शहरी क्षेत्रों से जो लोग ग्रामीण क्षेत्रों की ओर रिवर्स पलायन किए हुए हैं। अपने अपने गांवों में वापस आए हैं। उन वासियों को किस तरह राज्य में रोका जा सकता है, उनके लिए राज्य सरकार क्या नीति बनायेगी व राज्य के विकास में ये कुशल श्रमिक कैसे कार्य करेंगे। इसे लेकर भी यह शोध परियोजना रणनीति तैयार करेगी। इस दृष्टिकोण से भी यह शोध परियोजना वर्तमान में अपने आप में बहुत महत्वपूर्ण है। यह पलायन आज ना केवल हमारी सामाजिक समस्या है अपितु हमारी धरोहर, संस्कृति मूल्य व परम्परा को भी प्रभावित कर रही है व नगरों को भी प्रभावित कर रही है यह अध्ययन अपने आप में एक महत्वपूर्ण है जो कि पलायन पर एक नया दृष्टिकोण और कार्य प्रणाली लेकर आएगा। पलायन के कारणों व निवारण पर नवीनता लाने का कार्य करेगा।

प्रस्तुत शोध परियोजना की प्रासंगिकता व प्रस्तावित आउटपुट

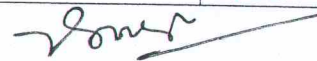
प्रस्तुत परियोजना की प्रासंगिकता इसलिए भी महत्वपूर्ण है कि यह सीमावर्ती राज्य है इसकी सीमाएं चीन व नेपाल से लगी हैं जो कि सामरिक दृष्टिकोण से बहुत महत्वपूर्ण है ये दोनों ही आपदा प्रभावित क्षेत्र भी हैं। खासकर जब आंकड़ा पिछले दो दशकों में 20 लाख लोगों के पलायन का हो तो वह भी सीमा करीब के 10 जिलों से यह अध्ययन राष्ट्रीय हित व सामरिक दृष्टि से बहुत महत्व रखता है। आखिरकार हिमालय और सेना के बाद की तीसरी सेना जो है वह हिमालयवासी हैं यदि यहां से यहीं के लोग शहरों में पलायन करेंगे तो सामरिक दृष्टि से भी ठीक नहीं होगा। इसलिए इस विषय पर शोध परियोजना के तहत कार्य करना अपने आप में बहुत समसामयिक व महत्वपूर्ण है उत्तराखण्ड के ऊपरी (पहाड़ी) जिलों से हो रहे पलायन को रोकना बेहद जरूरी है खासकर पिथौरागढ़, बागेश्वर व अल्मोडा तथा पौड़ी, उत्तरकाशी, रुद्रप्रयाग, चमोली जैसे जिलों से पलायन के कारणों का अध्ययन कर इस शोध परियोजना के कार्य से निकलने वाला आउटपुट राज्य के पलायन को रोकने में महत्वपूर्ण होंगे। जब भी राज्य सरकार इन जिलों के लिए या केन्द्र सरकार इस राज्य के

लिए पलायन पर कोई नीति बनायेगी तो उस समय यह शोध परियोजना की रिपोर्ट के आउटपुट अपने आप में प्रासंगिक होगी। इस परियोजना के आउटपुट से पलायन को रोकने के लिए उपाय व सुदूर गांवों के लिए रोजगार के क्या साधन होंगे यातायात, बिजली, पानी, चिकित्सा व गुणवत्तापूर्ण शिक्षा व आजीविका के नए विकल्प तलाशने व इस क्षेत्र की बुनियादी जरूरतों के लिए दीर्घकालिक व नीतिगत निर्णय जैसे सवालों पर निष्कर्ष निकाला जाएगा। उत्तराखण्ड में विकेंद्रित स्तर पर शिक्षा, चिकित्सा, खेती, बागवानी, वन्य जीव, वनोपज, जैव तकनीकी, खाद्य प्रसंस्करण जैसी व फल फूल औषधि व जैविक खेती बागवानी पट्टियों के विकास की योजनाओं पर भी आउटपुट निकालना इस शोध परियोजना का लक्ष्य है। इस परियोजना के आउटपुट से विशेषकर ग्रामीण समाज के लोगों को लाभ होगा। इस पर शोध पत्र व पुस्तक लेखन का कार्य भी किया जाएगा। चूंकि यहां प्राकृतिक संसाधनों में हिमालय, विभिन्न प्रजाति की बनस्पति, जडी बुटियां, भुद्व पर्यावरण, गंगा व इसकी सहायक धाराएं, धार्मिक व पर्याटन समृद्धि व जल, जंगल, जमीन का यह राज्य प्राणाधार है। नीति निर्माण की दृष्टि से इसका व्यावहारिक महत्व अपेक्षित है। इस शोध परियोजना के कार्य से जो तथ्य पलायन को रोकने के लिए आएंगे वह ना केवल उत्तराखण्ड बल्कि विहार, उड़ीसा व बंगाल जैसे राज्यों के लिए भी महत्वपूर्ण साबित होंगे चूंकि इन राज्यों से भी मजदूर वर्ग बहुत अधिक संख्या में रोजी रोटी के लिए पलायन करते हैं। विशेषकर उत्तराखण्ड राज्य के लिए इस शोध के परिणाम बहुत महत्वपूर्ण व प्रासंगिक होंगे। जिस समस्या से राज्य जूझ रहा है जो सामरिक दृष्टि से भी महत्वपूर्ण है। इस दिशा में उत्तराखण्ड के पहाड़ी जिलों से हो रहा पलायन को रोकने के लिए यह परियोजना एक नई नीति देगा।

अनुमानित बजट

2,00,000

क्र०स०	व्यापक व्यय प्रमुख	मूल्य
1	परियोजना कर्मचारी या सहायक क्षेत्र अन्वेषक का वेतन	90,000
2	फील्डवर्क यात्रा, लॉजिस्टिक्स बोर्डिंग	70,000
3	कंप्यूटर / प्रिंटर / किताबे	20,000
4	कंटीजैन्सी	10,000
5	शोध परियोजना रिपोर्ट का प्रकाशन	10,000
6	कुल	2,00,000



परियोजना निदेशक

डा० राकेश सिंह नेगी

सहायक प्रोफेसर राजनीति विज्ञान विभाग

हेमवती नंदन बहुगुणा गढवाल केन्द्रीय विश्वविद्यालय

श्रीनगर उत्तराखण्ड 246174

Note-Sheet
टिप्पणी तथा आज्ञायें

18/9/2023
विश्वविद्यालय

RDC-54344

शोध एवं विकास सेल द्वारा विश्वविद्यालय में शोध परक गतिविधियों के प्रोत्साहन एवं विकास हेतु संकाय सदस्यों/शोध छात्रों के लिये वित्तीय वर्ष 2020-2021, में लघु शोध प्रारम्भ की गयी थी परन्तु वित्तीय समिति के निर्णयानुसार धनराशि जारी नहीं की गई, विभिन्न प्रोजेक्ट के ओवरहेड में संचित धनराशि से इन परियोजनाओं को वित्तीय वर्ष 2023-2024 के लिये शुरु करने पर विचार किया जा सकता है। जिसमें चयनित संकाय सदस्य/छात्र/छात्राओं के लिये निर्गत की धनराशि का विवरण निम्नवत् है।

1. Annual Research Award: Dr. Alok Sagar Gautam Deptt. of Physics Rs 25000-00

2. Minor Research Projects for Faculties:

A. Science Rs. 2.50 Lakh is Sanctioned each faculty member

- | | |
|-------------------------------|------------------------|
| 1. Dr. Indrashis Bhattacharya | Deptt. of Zoology |
| 2. Dr. Subra Kala | Deptt. of Physics |
| 3. Dr. Brijesh Gangil | Mechanical Engineering |

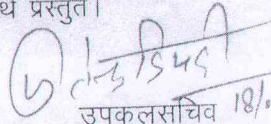
B. Humanities Rs. 2.0 Lakh is Sanctioned each faculty member

- | | |
|-----------------------|------------------------------|
| 1. Dr. Hira Lal Yadav | Deptt. of Physical Education |
| 2. Dr. Vishal Guleria | Deptt. of Law |
| 3. Dr. R. S. Negi | Deptt. of Political Science |

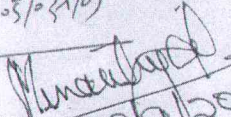
3. Minor Research Projects for Students Rs. 40000-00 is Sanctioned each Student member

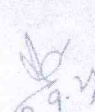
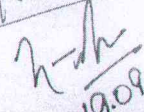
- | | |
|-------------------------|--------------------------|
| 1. Ms. Anjali Naik | School of Earth Sciences |
| 2. Mr. Akshay Bhama | School of Science |
| 3. Ms. Shilpi Rana | School of Agriculture |
| 4. Ms. Shilpa Negi | School of Life Sciences |
| 5. Mr. Prabal Dhasmana. | School of Engineering |

चूंकि उपरोक्त छात्र-छात्राओं के सन्दर्भ में उनके वर्तमान रजिस्ट्रेशन की स्थिति भी सत्यापित की जानी है अतः उपरोक्तानुसार लघु शोध परियोजना संकाय सदस्य हेतु प्रारम्भ करने एवं उक्त परियोजनाओं में आवंटित धनराशि को व्यय करने की वित्तीय एवं प्रशासनिक स्वीकृति हेतु आदेशार्थ प्रस्तुत।


उपकुलसचिव 18/9/23
(शोध एवं विकास प्रकोष्ठ)

निदेशक (आ.डी.सी.)


18/9/2023


R.F.O. / RVC / Hon'ble V.C.
18-9-23

19.09.23
Approved as per used
20.9.2023



हेमवती नन्दन बहुगुणा गढ़वाल विश्वविद्यालय
Hemvati Nandan Bahuguna Garhwal Univeristy
श्रीनगर गढ़वाल (उत्तराखण्ड)-246174
Srinagar (Garhwal), Uttarankhand - 246174
केन्द्रीय विश्वविद्यालय
(A Central Univeristy)

हे0न0ब0ग0वि0वि0/आर0सी0सी0/2021/755

दिनांक 26-07-2021

कार्यालय आदेश (755/2021/)

शोध एवं परामर्श समन्वय प्रकोष्ठ (RCC Cell) द्वारा विश्वविद्यालय में शोध परख गतिविधियों के प्रोत्साहन एवं विकास हेतु संकाय सदस्यों के लिए प्रारम्भ की गई लघु शोध परियोजना (Minor Research Project for Faculties) योजना अन्तर्गत संकाय सदस्यों से प्राप्त शोध प्रस्तावों की समीक्षा एवं जाँच तथा इन शोध प्रस्तावों पर संकाय सदस्यों द्वारा समिति के समक्ष किये गये प्रस्तुतीकरण के आधार पर समिति की संस्तुतियों पर कुलपति जी के अनुमोदनोपरान्त शैक्षिक सत्र 2021-22 से दो शैक्षिक सत्रों के लिये लघु शोध परियोजना निम्न संकाय सदस्यों को संलग्न शर्तों के आधार पर आवंटित करने की स्वीकृति प्रदान की जाती है।

(A) School of Science

1. Dr. Indrashis Bhattacharya
2. Dr. Subra Kala
3. Dr. Brijesh Gangil

Dept of Zoology
Dept of Physics
Mechanical Engineering

(B) School of Humanities and Social Science

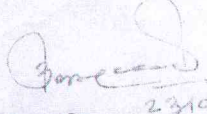
1. Dr. Hira Lal Yadav
2. Dr Vishal Guleria
3. Dr. R.S. Negi

Dept of Physical Education
Deptt. of Law
Deptt. of Political Science

आज्ञा से
कुलपति

प्रतिलिपि:- निम्नलिखित के सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. उक्त सम्बन्धित को।
2. समस्त संकायाध्यक्ष/विभागाध्यक्ष
3. वित्त अधिकारी।
4. निजी सचिव कुलसचिव।
5. निजी सचिव कुलपति, कुलपति महोदया के सादर सूचनार्थ।


कुलसचिव 23/07/21

3.1.2 The institution provides seed money to its teachers for research

3.1.2.1: The amount of seed money provided by institution to its faculty year- wise during the la

S.No	Name of the faculty receipt of Seed Money	Date of grant DD-MM-YYYY	Amount granted (INR in Lakhs)
1	Dr. Indrashis Bhattacharya	23-07-2021	2.50
2	Dr. Subra Kalal	23-07-2021	2.50
3	Dr. Brijesh Gangil	23-07-2021	2.50
4	Dr. Hira Lal Yadav	23-07-2021	2.00
5	Dr. Vishal Guleria	23-07-2021	2.00
6	Dr. R.S. Negi	23-07-2021	2.00

Note: Above grants has been sanctioned in the Year 2021-22 but was not released due to non app committee. Now in current year 2023-24 payment of grant is under process.



हेमवती नन्दन बहुगुणा गढ़वाल विश्वविद्यालय
Hemvati Nandan Bahuguna Garhwal Univeristy
श्रीनगर गढ़वाल (उत्तराखण्ड)-246174
Srinagar (Garhwal), Uttarankhand - 246174
केन्द्रीय विश्वविद्यालय
(A Central Univeristy)

हे0न0ब0ग0वि0वि0/आर0सी0सी0/2021/766

दिनांक 13-08-2021

कार्यालय आदेश

विषय :- लघु शोध परियोजना(संकाय सदस्य) अन्तर्गत शोध शीर्षक " Exploring the Dimensions of Work life Balance and Right to Disconnect: With special Reference to Educational Institutions of district Tehri of Uttarakhand को वित्तीय अनुदान स्वीकृति के सम्बन्ध में।

कुलपति महोदय के अनुमोदनोपरान्त उक्त शोध परियोजना प्रस्ताव की स्वीकृति कुल धनराशि रु 1,18,000=00 सहित दो शैक्षिक सत्रों के लिये प्रदान की जाती है तथा स्वीकृत धनराशि को शोध परियोजना के व्यय शीर्षको में निम्नानुसार आवंटित किया जाता है।

S.no	Different Heads/Items	Amount (In Rs)
1	TA food and logging during visit of educational institutions (as per rules)	50,000=00
2	Books & Journals	10,000=00
3	Printing	3,000=00
4	Miscellaneous	5,000=00
5	Contingencies	50,000=00
	Total	1,18,000=00

आर0सी0सी0 की शोध नीति के अनुसार स्वीकृत धनराशि का आवंटन निम्नानुसार निर्गत किया जायेगा।

1. प्रथम वर्ष रु 60,000=00
2. द्वितीय वर्ष रु. 58,000=00

कृपया शोध परियोजना के कार्यों का निष्पादन संलग्न दिशा-निर्देशों के अनुरूप सुनिश्चित करने का कष्ट करें।

कुलसचिव

प्रतिलिपि:- निम्न के सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. डॉ0 विशाल गुलेरिया सहायक प्रोफेसर विधि टिहरी परिसर।
2. संकायाध्यक्ष/विभागाध्यक्ष
3. वित्त अधिकारी।
4. निजी सचिव कुलसचिव।
5. निजी सचिव कुलपति, कुलपति महोदय के सादर सूचनार्थ।
6. गार्ड फाईल।

12/08/21
कुलसचिव

A Project Proposal

On

Exploring the Dimensions of Work Life Balance and Right to Disconnect: With Special Reference to Educational Institutions of district Tehri of Uttarakhand

**Submitted by
Dr. Vishal Guleria**

“We think, mistakenly, that success is the result of the amount of time we put in at work, instead of the quality of time we put in.”

-Arianna Huffington, Co-founder and Editor-In-Chief of The Huffington Post

1. Introduction

Work plays a significant part in all our lives. Our earnings ensure that the lights stay on, there's food on the table and the rainy-day pot is full. Work-life balance involves a mixture of time management, commitment, and (most importantly) prioritization. In the fast-paced life of the 21st century, especially with the coming of new and emerging technologies in the field of communications, life for the common Man has become easy and stands revolutionized in more ways than one could have thought of. But this has come with a flip side attached to it. The technological breakthroughs like mobile phones and emails have also made us available to the whole world 24/7. And this has resulted in the thin life of our work life balance becoming blurred. In fact, it has become difficult to achieve work-life balance in today's unpredictable and fast-paced world. As we grow increasingly more connected through technology and social media, it is becoming more and more difficult to separate work from our personal lives. It is commonplace to check emails at all hours, take work calls at the dinner table and work on our laptops on weekends. What was unthinkable a decade ago and has now become acceptable and ingrained. How did this happen? And what are the consequences we are paying for it?

Studies have found that if an employee is expected to be available round the clock, he/she tends to exhibit risks of over-work like sleep deprivation, developing stress and being

emotionally exhausted. This persistent urge to respond to calls and e-mails (termed as 'telepressure'), constant checking of e-mails throughout the day, and even on weekends and holidays, is reported to have destroyed the work-life balance of employees. As people have been increasingly working from home, there is a blurring of lines between what is professional and personal life. Rising levels of anxiety, depression, and burnout are often associated with a constantly connected world of work.

Though this phenomenon was observable for more than a decade, it became wide spread and ingrained as a result of the ongoing COVID-19 pandemic. This holds especially true for the Teaching fraternity, whether it be School Teachers, or College Teachers or University Teachers in the Private or the Government set up. This was one area wherein the whole focus shifted online and all the offline Teaching and other related academic activities had to be shifted to the online mode. Online meeting apps like Zoom and Cisco webex which were literally unheard of in the pre lockdown era, became a household name. But COVID or no COVID, we certainly were moving in the wrong direction and were ourselves responsible for meddling with the delicate work life balance.

On the legislative front, an attempt was in fact made in year 2018 by way of the Right to Disconnect Bill which was introduced in the Lok Sabha by a Member of Parliament (as a private member's Bill) which sought to confer right on the employees to disconnect from their work and not to respond to any work related communication. In the light of the above, the proposed Project aims to undertake an empirical study in the district of Tehri and to find out whether the work life balance of the Teachers stands disturbed today and the affect which it is having on their health and well-being.

2. Review of Literature

For the purpose of the proposed project, the following literature has been surveyed:

- Paul M Secunda, The Employee Right to Disconnect, Notre Dam Journal of International & Comparative Law, Vol. 9, (2019)
- Meghna Ann Arunachalam & Aarti Halwai, An analysis of the ethics of lockdown in India, 2019 Asian Bioethics Review (2020)
- Dhruv Mukherjee, The right to disconnect: An Indian workforce perspective, <https://www.peoplesmatters.in/article/employee-relations/right-disconnect-indian-workforce-perspective-13475>

- Matthew Kelly, *Off Balance: Getting Beyond the Work-Life Balance Myth to Personal and Professional Satisfaction*, (2011)
- Mara Olekalns and Jessica A. Kennedy, *How Couples Can Find Balance While Working From Home*, *Harvard Business Review*, December (2020)
- Jonathan Wolfe, *The right to disconnect* (2018), <https://www.nytimes.com/2018/03/23/nyregion/new-york-today-the-right-to-disconnect.html>
- Roger Pua, *When it comes to work-life balance and the right to disconnect, we can't always have our cake and eat it too*, available at <https://www.todayonline.com/commentary/when-it-comes-work-life-balance-and-right-disconnect-we-cant-have-our-cake-and-eat-it-too>
- Read more at <https://www.todayonline.com/commentary/when-it-comes-work-life-balance-and-right-disconnect-we-cant-have-our-cake-and-eat-it-too>

3. National and International Perspective

The work life balance and the right to disconnect is a not a new or novel thought whose genesis lies in the COVID 19 pandemic. As stated earlier, this pandemic has only hastened the process which was in evolution since the turn of the 21st century at least, more so within the last 10-15 years. And this is not a country specific issue, rather this issue has global dimensions and people of all countries are facing similar problems as are being face by people in India. In fact it was Ms Supriya Sule (a sitting Member of Parliament) who first time introduced this concept of Right to Disconnect in the form of a Private Members Bill in the year 2018. This Bill sought to confer right on the employees to disconnect form their work and not to respond to any work-related communication. The preamble of this Bill focused “to establish an Employees' Welfare Authority to confer the right on every employee to disconnect from work related telephone calls and emails beyond work hours and on holidays and right to refuse to answer calls and emails outside work hours and for all matters connected therewith or incidental thereto.” The right to disconnect is designed to establish boundaries around the use of electronic communication after working hours and to provide employees with the right to not engage in any work-related activities at home. It is often looked upon as an individual right of the employee to not only disconnect but also to not be reprimanded for failing to connect – or rewarded for constantly staying connected.

Speaking of the International front, in August 2016, France adopted the “*El Khomri law*” which offered French employees the right to disconnect from work calls and emails during non-working hours. While the *El Khomri Law* provided the right to disconnect, it did not

define it, and instead obligated employers to negotiate the specifics concerning the required use of telecommunication tools with employees. If no agreement is reached, the employer may unilaterally implement its own chosen methods for honouring the right to disconnect. The law came into effect in January 2017. Since enactment of the *El Khomri* law, more countries have enacted or considered similar legislation. In 2017, Italy enacted a law requiring employers to clarify their employees' need to be responsive outside of normal working hours. Similarly, Philippines' legislature has introduced a bill providing a right to disconnect after normal hours. Indeed, Belgium, the Netherlands, Luxembourg, Québec, and the federal government of Canada have all proposed or considered adopting such a right. Most recent to jump on the bandwagon was Spain, which in November 2018, adopted its "Data Protection and Digital Rights Act." This new act provides, among other things, the right to disconnect during resting periods and holidays.

So, work life balance and the Right to Disconnect have taken off in a big way in the International scenario as well and in the times to come many more countries are expected to join the already significant list of countries who are giving legal protection to their employees and thus ensuring in the process that a healthy work life balance is maintained which would ultimately be good for the society and for the individual employee as well.

4. Objectives of the Study

The proposed research project endeavours to study the impact technology has made on the lives of the employees (Teachers) of Schools, Colleges and Universities in Tehri district especially in the present and post COVID 19 scenarios. The objectives of the proposed study are briefly laid out:

- To analyse the factors affecting work life balance and wellbeing of the respondents.
- To study the effects of work life balance and right to disconnect on wellbeing of the teachers' in light of the data collected from survey areas.
- To study and understand teachers' perceptions relating to need of enactment of laws and policies ensuring their right to disconnect and overall wellbeing.
- To study the change in the level of work life balance and wellbeing of teachers' in pre and post Covid-19 pandemic periods.

5. Methodology

During the course of this research, the researcher proposes to use a blend of both empirical and doctrinal methods. The researcher would endeavour to collect information from questionnaires drafted for the study from the respondents and the Universe for the study would be district Tehri. The respondents as stated above would be the Teachers of Schools, Colleges and Universities of District Tehri. Answers to the questions raised in the objectives as stated above would be sought from the respondents involved in the study.

Tools for data collection

- Structured Questionnaire
- Interviews

Structured questionnaire will be communicated online and data will be collected from the employees, comfortable with usage of online platform. Face to face interviews (semi structured) will be conducted with employees having no or little access to online platforms. The data so collected would be useful in coming to certain conclusions and the suggestions would flow from the same.

6. Expected Research Outcomes

The proposed project as stated earlier, is an attempt to study and examine the increasing influence of technology in disturbing the work life balance and throwing the mental calm, composure, health, relations of the individual employee off the grid. The researcher is treading on the hypothesis that the COVID 19 pandemic has hastened the onset of the dangerous culture of work being imposed/carried on by the employee much beyond his designated work hours which is impacting him adversely in the multifarious ways as stated supra. The research would also reflect upon the thinking of the respondents with regard to the need and necessity of a central legislation in the form of an enactment coming through which gives them a legal protection, an umbrella, from the scorching rays of technology penetrating their lives. The researcher expects to analyse and examine the specific points as stated above and draw conclusions from the same.

7. Benefits to the Society

This issue is a burning issue of the current times and it has been brought into focus more recently by the presently raging COVID 19 pandemic. The research in this area would have a clear and direct benefit to the society as a whole. The research would highlight the present plight of the respondents and thus bring to the fore their present state of being and the non-alignment of their previously aligned work life balance. The research would highlight how the employers (knowingly or unknowingly) have exceeded their domain and are seeking work and responses to mails even in non-working hours. The research would also highlight the urgent necessity of a legislation to cover this area and provide a legal protection to all the employees (whether government or in Private or in corporate sector).

8. Budget Details

S.No	Different Heads/Items	Amount
1.	TA, Food and lodging during visit of educational institutions (as per rule)	Rs. 50000.00
2.	Books & Journals	Rs. 10000.00
3.	Printing	Rs. 3000.00
4.	Mobile Expenditure	Rs. 5000.00
5.	Contingencies	Rs. 50000.00
		Total= Rs. 118000 (One Lakh Eighteen Thousand Only)

- 1. Key publications published by the Investigator during the last 5 years-** Mentioned in CV
- 2. Detailed CV of the PI-** Attached
- 3. Previous Projects Implemented by PI-** NIL
- 4. Name and address of two experts in area of proposal**
 - a. Prof. (Dr.) A. K. Pandey,** Head & Dean, School of Law, HNBGU, SRT Campus Badshahithaul, Mob. 9412141343
Email- pandey.ashok70@gmail.com

b. Prof. (Dr.) Sunil Deshta, Department of Laws, Himachal Pradesh University,
Shimla, Himachal Pradesh
Mob- 9418041271
Email- sunildeshta@gmail.com



हेमवती नन्दन बहुगुणा गढ़वाल विश्वविद्यालय
Hemvati Nandan Bahuguna Garhwal Univeristy
श्रीनगर गढ़वाल (उत्तराखण्ड)-246174
Srinagar (Garhwal), Uttarakhand - 246174
केन्द्रीय विश्वविद्यालय
(A Central Univeristy)

हे0न0ब0ग0वि0वि0 / आर0सी0सी0 / 2021 / 766

दिनांक 13-08-2021

कार्यालय आदेश

विषय :- लघु शोध परियोजना (संकाय सदस्य) अन्तर्गत शोध शीर्षक "Investigation of Thermoelectric Properties of Copper Sulfide and Ag doped Copper Sulfide Nanoparticles Prepared by Green Approach" को वित्तीय अनुदान स्वीकृति के सम्बन्ध में।

कुलपति महोदय के अनुमोदनोपरान्त उक्त शोध परियोजना प्रस्ताव की स्वीकृति कुल धनराशि रु 2.50 लाख सहित दो शैक्षिक सत्रों के लिये प्रदान की जाती है तथा स्वीकृत धनराशि को शोध परियोजना के व्यय शीर्षको में निम्नानुसार आवंटित किया जाता है।

S.No	Head	Cost (in Lakh)
1	Equipments	1.50
2	Consumables	0.50
3	Contingency	0.50
	Total	2.50

आर0सी0सी0 की शोध नीति के अनुसार स्वीकृत धनराशि का आवंटन निम्नानुसार निर्गत किया जायेगा।


1. प्रथम वर्ष रु 1.25 लाख .
2. द्वितीय वर्ष रु.1.25 लाख

कृपया शोध परियोजना के कार्यों का निष्पादन संलग्न दिशा-निर्देशों के अनुरूप सुनिश्चित करने का कष्ट करें।

1
कुलसचिव

प्रतिलिपि:- निम्न के सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. डॉ0 शुभ्रा काला सहायक प्रोफेसर भौतिक विज्ञान विभाग श्रीनगर ।
2. संकायाध्यक्ष / विभागाध्यक्ष
3. वित्त अधिकारी ।
4. निजी सचिव कुलसचिव ।
5. निजी सचिव कुलपति, कुलपति महोदया के सादर सूचनार्थ ।
6. गार्ड फाईल ।


12/08/21
कुलसचिव



हेमवती नन्दन बहुगुणा गढ़वाल विश्वविद्यालय
Hemvati Nandan Bahuguna Garhwal University
श्रीनगर गढ़वाल (उत्तराखण्ड)-246174
Srinagar (Garhwal), Uttarakhand - 246174
केन्द्रीय विश्वविद्यालय
(A Central University)

हे0न0ब0ग0वि0वि0 / आर0सी0सी0 / 2021 / 766

दिनांक 13-08-2021

कार्यालय आदेश

विषय :- लघु शोध परियोजना अन्तर्गत(संकाय सदस्य) शोध शीर्षक "Investigating Mechanical and Tribological Properties of Hybrid Aluminium Metal Foam for Automotive Application" को वित्तीय अनुदान स्वीकृति के सम्बन्ध में।

कुलपति महोदय के अनुमोदनोपरान्त उक्त शोध परियोजना प्रस्ताव की स्वीकृति कुल धनराशि रु 1,76,400=00 सहित दो शैक्षिक सत्रों के लिये प्रदान की जाती है तथा स्वीकृत धनराशि को शोध परियोजना के व्यय शीर्षको में निम्नानुसार आवंटित किया जाता है।

S.no	Item	BUDGET (in Rupees)			
		1 st Year (Approximate Rate)	2 nd year	Total	
A	Material Procurement	Aluminium 50 Kg @450/Kg	22500=00		
		Calcium Granules 2 Kg @ 8000/kg	16000=00		
		caco3 Powder 2 Kg @ 1500/kg	3000=00		
		Manganese Powder 1kg@1000 / Kg	1000=00		
		Manganese Powder 2kg@1000 / Kg	3000=00		
		Zinc Powder 1 Kg @ 400/kg	400=00		
		Coal 500 kg @ 30/kg	15000=00		
		Graphite Crucibles 15@	10500=00		
		71400=00		71400=00	
B	Contingency/ Characterization	25,000=00	50,000=00	75,000=00	
C	Travel /Conferences	10,000=00	20,000=00	30,000=00	
D	Grant Total (A+B+C)	1,06,400=00	70000=00	1,76,400 =00	

आर0सी0सी0 की शोध नीति के अनुसार स्वीकृत धनराशि का आवंटन निम्नानुसार निर्गत किया जायेगा।

1. प्रथम वर्ष रु 1,00,000=00
2. द्वितीय वर्ष रु 76,400=00

कृपया शोध परियोजना के कार्यों का निष्पादन संलग्न दिशा-निर्देशों के अनुरूप सुनिश्चित करने का कष्ट करें।

कुलसचिव

प्रतिलिपि:- निम्न के सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. डॉ० बृजेश गांगिल सहायक प्रोफेसर मैकेनिकल्स इंजीनियरिंग विभाग श्रीनगर ।
2. संकायाध्यक्ष / विभागाध्यक्ष
3. वित्त अधिकारी ।
4. निजी सचिव कुलसचिव ।
5. निजी सचिव कुलपति, कुलपति महोदय के सादर सूचनार्थ ।
6. गार्ड फाईल ।

कुलसचिव


13/08/21



हेमवती नन्दन बहुगुणा गढ़वाल विश्वविद्यालय
Hemvati Nandan Bahuguna Garhwal University
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(A Central University)

हे0न0ब0ग0वि0वि0 / आर0सी0सी0 / 2021 / 766

दिनांक 13-08-2021

कार्यालय आदेश

विषय :- लघु शोध परियोजना अन्तर्गत(संकाय सदस्य) शोध शीर्षक "Investigating Mechanical and Tribological Properties of Hybrid Aluminium Metal Foam for Automotive Application" को वित्तीय अनुदान स्वीकृति के सम्बन्ध में।

कुलपति महोदय के अनुमोदनोपरान्त उक्त शोध परियोजना प्रस्ताव की स्वीकृति कुल धनराशि रु 1,76,400=00 सहित दो शैक्षिक सत्रों के लिये प्रदान की जाती है तथा स्वीकृत धनराशि को शोध परियोजना के व्यय शीर्षको में निम्नानुसार आवंटित किया जाता है।

S.no	Item	BUDGET (in Rupees)			
		1 st Year (Approximate Rate)	2 nd year	Total	
A	Material Procurement	Aluminium 50 Kg @450/Kg	22500=00		71400=00
		Calcium Granules 2 Kg @ 8000/kg	16000=00		
		caco3 Powder 2 Kg @ 1500/kg	3000=00		
		Manganese Powder 1kg@1000 / Kg	1000=00		
		Manganese Powder 2kg@1000 / Kg	3000=00		
		Zinc Powder 1 Kg @ 400/kg	400=00		
		Coal 500 kg @ 30/kg	15000=00		
		Graphite Crucibles 15@	10500=00		
		71400=00			
B	Contingency/ Characterization	25,000=00	50,000=00	75,000=00	
C	Travel /Conferences	10,000=00	20,000=00	30,000=00	
D	Grant Total (A+B+C)	1,06,400=00	70000=00	1,76,400 =00	

आर0सी0सी0 की शोध नीति के अनुसार स्वीकृत धनराशि का आवंटन निम्नानुसार निर्गत किया जायेगा।

1. प्रथम वर्ष रु 1,00,000=00
2. द्वितीय वर्ष रु 76,400=00

कृपया शोध परियोजना के कार्यों का निष्पादन संलग्न दिशा-निर्देशों के अनुरूप सुनिश्चित करने का कष्ट करें।

कुलसचिव

प्रतिलिपि:- निम्न के सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. डॉ० बृजेश गांगिल सहायक प्रोफेसर मैकेनिकल्स इंजीनियरिंग विभाग श्रीनगर ।
2. संकायाध्यक्ष / विभागाध्यक्ष
3. वित्त अधिकारी ।
4. निजी सचिव कुलसचिव ।
5. निजी सचिव कुलपति, कुलपति महोदय के सादर सूचनार्थ ।
6. गार्ड फाईल ।

कुलसचिव


13/08/21

Investigating Mechanical and Tribological Properties of Hybrid Aluminum Metal Foam for Automotive Application

Submitted by
Dr. Brijesh Gangil
Assistant Professor,
Mechanical Engineering Department,
HNB Garhwal University

1. Introduction of the Proposal

Applications of lightweight materials not only bring the potential for automobile industry to reduce the weight of vehicle but also simultaneously satisfy the new regulations of fuel economy and emissions. A few lightweight materials have been introduced in the automotive industry such as aluminum, magnesium, honeycomb material, and composite materials. One of the materials that can potentially impact the automobile industry as a structural material is metal foam.

Metal foam

Metal foams are cellular solids that exhibit an exciting set of physical and mechanical properties owing to their complex morphology. The foam morphology consists of a metallic matrix in which single gas inclusions are finely dispersed and totally enclosed by the solid. High stiffness to weight ratio, the low specific weight, the high energy absorption during plastic deformation, good mechanical strength and recyclability [1-3] are among its properties which have made them attractive for current and future applications on the automotive and construction industries among others. Aluminum foams are also good candidates for a wide range of functional applications [2]. If we consider the structural aspect of metal foams, there are three most common cell structures, namely, open cell structure, closed cell structure [1] and a combination of the two [6]. Recently, a novel structure has been developed, which is known as lotus-type growth structure [7,8]. The open cell structures incorporate interconnected pores, whereas, in closed cell structures, pores are surrounded by a metallic thin wall. The lotus-type morphology consists of long cylindrical pores aligned in one direction. Structural applications are oriented to closed cell foams while functional applications require materials with open porosity.

Techniques of development of foam

There are different ways to fabricate aluminium metal foams. One method is by injecting gas into the liquid metal. Other approaches involve the introduction of a gas or gas-release

blowing agent into the melt or producing supersaturated metal-gas solutions. Indirect methods include investment casting, the use of space filler materials and the melting of powder compacts, which contain a blowing agent. If inert gas is entrapped in powder compacts, a subsequent heat treatment can yield metal foams. The same holds for various sintering methods, metal powder slurry foaming, or extrusion and sintering of polymer/powder mixtures. Electro-deposition or metal vapor deposition also allow for the production of highly porous metallic structures [2].

Generally the techniques used by researchers are powder metallurgy and melt route method. Melt route method is effective technique for preparation of metal foam, many industries use this technique to reduce the cost of foam and use them in cost driven products. In melt route method blowing agent is added to the melt which then decomposes under the influence of heat and releases gas which then propels the foaming process.

2. Review of Literature

L.E.G. Cambronero et al. (2009) manufactured AL-Mg-Si alloy foam using natural carbonate powder and chemical calcium carbonate powder as blowing agent through powder metallurgy method. It concludes that calcium carbonates can be well utilised as foaming agent for producing foam through PM method. The density of the produced foams was between 0.53-0.56 g/cm³. The compressive strength obtained was 6.11MPa and energy absorption was 1.8kJ/m³.

M. Heidari Ghaleh et al.(2020) prepared A356 Close cell aluminium foam through melt route method only by using CaCO₃ as blowing agent. The density of the foam was ranging between 0.32 to 0.46 g/cm³ and the cell size were ranged between 1.5 to 3.1 mm. The compressive properties and energy absorption properties increases with increase in relative densities. But elastic modulus of the foamed aluminum with 3 wt% CaCO₃ (relative density = 14%) is higher than others because its cell size distribution is more homogeneous than others.

Donghui Yang et al.(2016) fabricated close cell Cu-Mg alloy foam by using powder metallurgy technique. In their study, they have taken pure Cu powder and Mg powder to fabricate foam by using CaCO₃ as blowing agent. The key in developing successful metal foam is to form an intermettalic (Mg₂Cu/MgCu₂) which should have lower melting temperature by sintering treatment. They found that the prepared foam was brittle but Mg in the foam matrix is beneficial for increasing the compressive strength.

Neu et al. [2011] studied Mg and Mg-Al alloy foams prepared by two different methods, with conventional foaming under 1 bar and pressure induced foaming. When Al is varied (0% to 17%) in the Mg melt the ductility of foam increases which in turn increases consolidation. Al was also responsible for large expansion.

Liu et al [2016] developed Al-Si-SiC composite foam by melt route method and performed the compression test at elevated temperature and found the brittle compressive behavior of foam at room temperature as well as at elevated temperatures. The material of the cell wall has significant effect on compressive properties and energy absorption characteristics, which can be obtained by adding the appropriate particles in optimum percentage into parent metal.

Choi et al [2017] studied the compression and wear behavior of freeze-cast Ti and Ti-5W alloy foams, which were further predicted by an analytical model and compared with experimental results for finding the suitability in biomedical applications.

Xia et al [2013] developed closed-cell aluminum foams via melt route method by adding Mn particle in varying percentage (0, 0.2, 1.0, 2.0 and 4.0%) and found that Mn element was uniformly distributed in the cell wall matrix which assisted in increasing the compressive strength.

Bisht and Gangil [2018] prepared Al metal foam by adding Zn particles in different weight percentage (0, 0.5 and 1%) and demonstrated a significant improvement in compression strength due to the uniform distribution of Zn particles in cell wall matrix.

Sharifi et al [2017] checked the dry sliding wear behavior of open-cell Al-Mg/Al₂O₃ and Al-Mg/SiC-Al₂O₃ composite pre-foams and found that the wear behavior depended on the density and pores per inch. The results showed that lower wear rates were obtained with smaller cell sizes and higher densities.

Suresh Kumar and O.P. Pandey [2016] prepared LM 13 alloy foams via the melt route method using pre-treated CaCO₃ at 300⁰C as blowing agent. The study was conducted for optimizing the various parameters like melt temperature, size and amount of blowing agent and stirring time for producing uniform size foams. It was observed that the distribution of blowing agent depends upon viscosity of the melt and stirring speed. In their analysis they found 875⁰C as effective foaming temperature while using 2wt% CaCO₃.

3. National and International Status

Being a new material for research it is gaining interest between researchers to utilize it in various applications as structural and functional material. A number of new metal foaming technologies have been developed in the past decade that enable a wide range of forms for this exciting material. Compared with early developments in the 1960s and 1970s, the quality of metal foams has improved, and the possibilities for making composites using it have widened. It seems quite realistic that metal foams will find real applications very soon in cars, ships, aircrafts and even spacecraft.

National Status

As it is mentioned that metal foams are very close to find realistic application, national researchers have also made some appreciable attempt in development and finding applications.

Venkat Pamidi and Manas Mukherjee:-A novel method to produce foams from metallic melts was invented. It is referred here as *melt injection* method. An apparatus to produce foams by melt injection method was also developed. In this method, bubbles are created by injecting a jet of molten metal into a pool of molten metal. These bubbles rise to the surface of melt pool and create a foam there. This method works without the need of an additional processing step to produce or add stabilising particles in the melt

Praveen K. Pinnoji , Nicolas Bourdet , Puneet Mahajan , Remy Willinger New motorcycle helmets are designed with metal foam shell and their impact behaviour were observed. Impact experiments have been performed on a first set of prototype helmets with metal foam shell at standard impact locations. The biomechanical characteristics of head impact were studied with both metal foam and ABS helmets. The helmet with metal foam shell performed reasonably well compared to ABS helmet.

Ankur Bisht and Brijesh Gangil: Aluminium metal foam was successfully prepared in Pit furnace with stirring arrangements. It reduces the cost of foam production. The method used was melt route method and bubbles were produced by using CaCO₃ as blowing agent. The foams obtained have good yield strength as well as longer plateau region in comparison to previously reported researches.

International Status

Gerhardi&Cie: Developed Front Impact Absorber and had a patent on it. In it impact energy is absorbed in crash box before longitudinal member is deformed. Important thing is that they are exchangeable elements and facilitate repair after low velocity crashes and reduce costs.

S. Reinhardt: Vacuum elevator tool manufactured for Pilkington, a large manufacturer of flat glass products. The tool is used to lift glass panels produced in the floating glass process. The replacement of the full aluminum part by Alporas foam led to a weight reduction from 82 to 32 kg. Since the change of these tools is carried out manually, this reduced weight facilitates handling. The production is still small scale (i.e.,5–6 pieces per year) but demonstrates the benefit of using aluminium foam for light-weight structural components.

J.Banhart: Stiffeners in door still are produced by Alulight foam. It provides a light weight structure with high energy absorption characteristic.

Important commercial developments also took place in the automotive industry. Nett Technologies Inc. is presently using open-cell metallic foams for the production of their catalytic converters for diesel engines. Vale Inco Ltd and Sud-Chemie AG have recently agreed to establish a joint venture, Alantum, for the production and marketing of catalysed diesel emission control materials. The company will concentrate initially on diesel oxidation

catalysts (DOC) and diesel particulate filters (DPF) applications for European passenger car and light truck markets.

Another important commercial application of metallic foams and porous metals are the production of biomedical implants. Porous coatings (sintered beads and meshes) have been used with success for the last 20 years in orthopaedic applications and most orthopaedic implant manufacturers are using these coatings on many of their implants. The companies are now developing metallic foams to improve the performance of their implants and to develop implants for new and improved surgical treatments. Major orthopaedic implant manufacturers are now bringing these materials into the market (Hedrocell from Zimmer, Tritanium from Stryker, Regenerex from Biomet, Gription from DePuy).

4. Proposed Objectives

The past work accomplished identified several international and National Researchers who have accomplished research on fabrication, characterization, testing, and foam machining. The unique combination of physical and mechanical properties offered by porous metals that cannot be obtained with dense metals, or either dense or porous polymers and ceramics, makes them attractive materials for exploitation. The interest mainly focuses on exploiting their ability to incorporate them into strong, stiff, lightweight structures, particularly ability to absorb energy and workable in moderate sliding conditions.

The proposal aims to develop metal foam, which will be suitable for a structural element that possess higher compressive strength with flatter and longer plateau for energy absorption and can be utilized in moderate sliding condition. Mn, Mg and Zn can be added as the alloying element in Al to produce metal foam with desired properties. Commercial Mn granules are cheap and easy to obtain; adding an appropriate amount of Mn elements into the commercially pure Al foams could be a feasible and effective route to obtain high-strength Al foams. Zn is used in Al alloy series, which provides highest strength among other Al alloys. Mg is helpful in improving the binding strength and castability. Thus Al foam with better mechanical and sliding properties can be prepared by adding Mn, Mg and Zn as alloying elements. As per the literature review, no work is reported on the fabrication of hybrid metal foam by adding Mn, Mg and Zn in particulate form during the manufacturing process of metal foam through melt route method. The tentative material composition in tabular form is mentioned below

Designation	Composition			
	Aluminium (%)	Zinc (%)	Magnesium (%)	Manganese (%)
Foam-0	100	0	0	0
Foam-1	100	1	2	1
Foam-2	100	1	2	2
Foam-3	100	1	2	4

Selection of the proportion of the alloying elements is based on past researches. Material will be fabricated through melt route method. The fabrication procedure will have these following steps:

Step I: A certain amount of pure Al will be placed in the crucible for complete melting.

Step II: After this, 2 wt.% Ca granules will be added and stirred for 5 min at 600 rpm, but in the case when alloying elements will be added, initially stirring of Al + Ca (2 wt.%) will be done for 3 min and then followed by 2 minutes for each and every particle addition.

Step III: Then CaCO₃ will be added in the ratio of 1:100 wt.% of Al and will be stirred for 2 min at 200 rpm.

Step IV: The crucible has to be hold for a short interval of time for 5–10 s for complete expansion of foam.

Step V: Finally the crucible will be removed from the furnace and air cooled.

During the entire procedure, except for the last step, the temperature of the melt was maintained at 953±5 K.

After the successful fabrication of samples, they will be cut for physical, mechanical and tribological characterisation. The density of the samples will be measured by Archimedes principle. The fabricated samples will be cut in cubical shape for performing uniaxial compression test. The tests will be performed on universal testing machine with a pace rate of 0.2mm/s. From the stress-strain curve, energy absorption and young modulus will be calculated. The tribological test will be conducted on Pin on Disc apparatus in dry sliding condition to obtain the material's specific wear rate. Microstructure and the distribution of alloying particles in the foam will be characterized by scanning electron microscope.

5. Work Plan including timelines

The Year-wise breakup of work Plan is given below:

<u>S.No</u>	Activity	1-4	5-8	9-12
Phase 1	Literature review	←	→	
Phase 2	Procurement of raw materials		←	→
Phase 3	Development/fabrication of Metallic Foam		←	→
Phase 5	Physical and Mechanical Characterization			←

S.N.	Activity	1-4	5-8	9-12	13-16	17-20	21-24
Phase-1	Literature Review	←→					
Phase-2	Procurement of Raw Material		←→				
Phase-3	Development/ Fabrication of metal foam		←→				
Phase-4	Physical and Mechanical Characterisation			←→			
Phase-5	Tribological and Thermal Characterisation				←→		
Phase-6	Publication and Report					←→	

6. Expected Research Outcome

The prepared material will find suitable application in light weight construction where moderate sliding properties are required. Key possible outcomes are listed below:

- During the research economical aluminium metal foams will be developed successfully.
- Produced material will be light weighted and have uniform distribution of pores.
- The material will possess good yield strength and longer plateau region, which in turn will help them to enhance their energy absorption characteristic.
- It is expected that the material prepared will possess good tribological property.
- The mechanism behind the wear of materials will also be identified.

7. Expected Benefits to the Society

1. The automotive industry currently uses aluminum and its alloys to minimize the vehicle's weight that increases fuel efficiency. The prepared metallic foam will be lightweight material and about 10 times lighter than Aluminium and have the potential to replace them.
2. The vehicle weight directly impacts to CO₂ emissions, on an average, 100kg mass reduction achieved on a passenger car saves:
 - 0.35 litre of fuel per 100km
 - 9 grams of CO₂ per km at the car exhaust

Thus, with weight reduction, the fuel demand would be decreased and help to manage CO₂ emissions proportionally.

- Besides the above advantages, additional noise absorption and vibration damping benefits can also be achieved by using metallic foams.

Budget Details (Including Different Heads)

	Item	BUDGET (in Rupees)			
		1 st Year (Approximate Rate)	2 nd Year	Total	
A.	Material procurement	Aluminium 50 Kg @450/Kg	22,500/-		71,400/-
		Calcium Granules 2 kg@8000/Kg	16000/-		
		CaCO ₃ Powder 2Kg@ 1500/Kg	3000/-		
		Manganese Powder 1Kg@ 1000/Kg	1000/-		
		Magnesium Powder 2Kg@ 1500/Kg	3000/-		
		Zinc Powder 1Kg@ 400/Kg	400/-		
		Coal 500kg@30/kg	15000/-		
		Graphite Crucibles 15@ 700/Kg	10500		
			71,400/-		

B	Contingency/ Characterization	25,000/-		50,000/-	75,000/-
C	Travel/Conferences	10,000/-		20,000/-	30,000/-
D	Grand total (A+B+C)	1,06,400/-		70,000/-	1,76,400/-

8. Previous Projects Implemented by P.I:

S.No	Title of Project	Cost in Lakh	Duration	P.I. Name	Awarding Agency	Status of Project
1.	Design and Development of Biomechanical analysis of Femur bone joint	2,20,000/-	02	Ms. Anamika Bhandari, Mr. Faraz Ahamad, Dr. Brijesh Gangil	Competative Research of Technical Education Quality Improment Programme (TEQIP-III), Uttarakhand	Ongoing

9. Key Publications Published By Investigator

Publications during the last five years (2015-2020)

1. Singh, T., Patnaik, A., Gangil, B., & Chauhan, R. (2015). Optimization of tribo-performance of brake friction materials: effect of nano filler. *Wear*, 324, 10-16. SCI, Impact factor 2.9
2. Kumar, S., Gangil, B., & Patel, V. K. (2016, May). Physico-mechanical and tribological properties of grewiaoptivafiber/bio-particulates hybrid polymer composites. In AIP conference proceedings (Vol. 1728, No. 1, p. 020384). AIP Publishing LLC. Scopus Indexed.
3. Gangil, B., Kothiyal, P., & Kumar, S. (2016, May). Experimental investigation of machining process parameters in conventional turning of Al-7075 on MRR using response surface methodology. In AIP Conference Proceedings (Vol. 1728, No. 1, p. 020631). AIP Publishing LLC. Scopus Indexed.
4. Kumar, S., Gangil, B., Prasad, L., & Patel, V. K. (2017). A Review on mechanical behaviour of bast-glass fibre based hybrid polymer composites. *Materials Today: Proceedings*, 4(9), 9576-9580. Scopus Indexed.
5. Kumar, S., Kumar, Y., Gangil, B., & Patel, V. K. (2017). Effects of agro-waste and bio-particulate fillers on mechanical and wear properties of sisal fibre based polymer composites. *Materials Today: Proceedings*, 4(9), 10144-10147. Scopus Indexed.

6. Singh, T., Chauhan, R., Patnaik, A., Gangil, B., Nain, R., & Kumar, A. (2018). Parametric study and optimization of multiwalled carbon nanotube filled friction composite materials using Taguchi method. *Polymer Composites*, 39(S2), E1109-E1117. SCI, Impact factor 2.0
7. Bisht, A., & Gangil, B. (2018). Structural and physico-mechanical characterization of closed-cell aluminum foams with different zinc additions. *Science and Engineering of Composite Materials*, 25(4), 789-795. SCI, Impact factor 0.8
8. Tejyan, S., Singh, T., Patnaik, A., Fekete, G., & Gangil, B. (2019). Physico-mechanical and erosive wear analysis of polyester fibre-based nonwoven fabric-reinforced polymer composites. *Journal of Industrial Textiles*, 49(4), 447-464. SCI, Impact factor 1.7.
9. Kumar, S., Patel, V. K., Mer, K. K. S., Fekete, G., Gangil, B., & Singh, T. (2018). Influence of woven bast-leaf hybrid fiber on the physico-mechanical and sliding wear performance of epoxy based polymer composites. *Materials Research Express*, 5(10), 105705. SCI, Impact factor 1.44.
10. Singh, T., Patnaik, A., Fekete, G., Chauhan, R., & Gangil, B. (2019). Application of hybrid analytical hierarchy process and complex proportional assessment approach for optimal design of brake friction materials. *Polymer Composites*, 40(4), 1602-1608. SCI, Impact factor 2.0.
11. Singh, T., Gangil, B., Patnaik, A., Kumar, S., Rishiraj, A., & Fekete, G. (2018). Physico-mechanical, thermal and dynamic mechanical behaviour of natural-synthetic fiber reinforced vinylester based homogenous and functionally graded composites. *Materials Research Express*, 6(2), 025704. SCI, Impact factor 1.44.
12. Nadda, R., Kumar, R., Singh, T., Chauhan, R., Patnaik, A., & Gangil, B. (2018). Experimental investigation and optimization of cobalt bonded tungsten carbide composite by hybrid AHP-TOPSIS approach. *Alexandria engineering journal*, 57(4), 3419-3428. SCI, Impact factor 1.2.
13. Singh, T., Gangil, B., Patnaik, A., Biswas, D., & Fekete, G. (2019). Agriculture waste reinforced corn starch-based biocomposites: effect of rice husk/walnut shell on physicomachanical, biodegradable and thermal properties. *Materials Research Express*, 6(4), 045702. SCI, Impact factor 1.44.
14. Kumar, S., Mer, K. K. S., Gangil, B., & Patel, V. K. (2019). Synergy of rice-husk filler on physico-mechanical and tribological properties of hybrid Bauhinia-vahlilii/sisal fiber reinforced epoxy composites. *Journal of Materials Research and Technology*, 8(2), 2070-2082. SCI, Impact factor 5.1.
15. Gairola, S., Joshi, A., Gangil, B., Rawat, P., & Verma, R. (2019). Correlation of tensile properties and fracture toughness with microstructural features for Al-Li 8090 alloy processed by cryorolling and post-rolled annealing. *Transactions of the Indian Institute of Metals*, 72(7), 1743-1755. SCI, Impact factor 1.3.

16. Kumar, S., Patel, V. K., Mer, K. K. S., Gangil, B., Singh, T., & Fekete, G. (2019). Himalayan natural fiber-reinforced epoxy composites: Effect of *grewiaoptiva/bauhinia vahlii* fibers on physico-mechanical and dry sliding wear behavior. *Journal of Natural Fibers*, 1-11. SCI, Impact factor 2.4.
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18. Singh, T., Gangil, B., Singh, B., Verma, S. K., Biswas, D., & Fekete, G. (2019). Natural-synthetic fiber reinforced homogeneous and functionally graded vinylester composites: Effect of bagasse-Kevlar hybridization on wear behavior. *Journal of Materials Research and Technology*, 8(6), 5961-5971. SCI, Impact factor 5.1.
19. Verma, S. K., Gupta, A., Singh, T., Gangil, B., Jánosi, E., & Fekete, G. (2019). Influence of dolomite on mechanical, physical and erosive wear properties of natural-synthetic fiber reinforced epoxy composites. *Materials Research Express*, 6(12), 125704. SCI, Impact factor 1.44.
20. Kumar, S., Mer, K. K. S., Gangil, B., & Patel, V. K. (2020). Synergistic effect of hybrid Himalayan Nettle/*Bauhinia-vahlii* fibers on physico-mechanical and sliding wear properties of epoxy composites. *Defence Technology*, 16(4), 762-776. SCI, Impact factor 1.5.
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23. Khare, J. M., Dahiya, S., Gangil, B., & Ranakoti, L. (2020). Influence of different resins on Physico-Mechanical properties of hybrid fiber reinforced polymer composites used in human prosthetics. *Materials Today: Proceedings*. Scopus Indexed.
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25. Ravi Gupta, Kamlesh Kushwah, Sanjay Goyal, Brijesh Gangil, Ankush Sharma. (2020). Ramie-glass fiber reinforced epoxy composites: Impact of walnut content on mechanical and sliding wear properties. *Materials Today: Proceedings*. Scopus Indexed.
26. Tejyan, S., Sharma, D., Gangil, B., Patnaik, A., & Singh, T. (2020). Thermo-mechanical characterization of nonwoven fabric reinforced polymer composites. *Materials Today: Proceedings*.

27. Gupta, A., Joshi, A., Tejyan, S., Gangil, B., & Singh, T. (2020). Comparative study of mechanical properties of orange peel filled epoxy composites joined by a mechanical fastener. *Materials Today: Proceedings*.

10. Detailed CV of PI:

Attached

12. Name and address of two experts in the area of the proposal

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4. Banhart J. *JOM* 2000, 52, 22–27.
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9. Yang, Donghui, et al. "Fabrication of Mg-Al alloy foam with close-cell structure by powder metallurgy approach and its mechanical properties." *Journal of Manufacturing Processes* 22 (2016): 290-296.
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15. Sharifi, Hassan, et al. "Dry sliding wear behavior of open-cell Al-Mg/Al₂O₃ and Al-Mg/SiC-Al₂O₃ composite preforms produced by a pressureless infiltration technique." *Tribology International* 116 (2017): 244-255.
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Investigating Mechanical and Tribological Properties of Hybrid Aluminum Metal Foam for Automotive Application

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1. Introduction of the Proposal

Applications of lightweight materials not only bring the potential for automobile industry to reduce the weight of vehicle but also simultaneously satisfy the new regulations of fuel economy and emissions. A few lightweight materials have been introduced in the automotive industry such as aluminum, magnesium, honeycomb material, and composite materials. One of the materials that can potentially impact the automobile industry as a structural material is metal foam.

Metal foam

Metal foams are cellular solids that exhibit an exciting set of physical and mechanical properties owing to their complex morphology. The foam morphology consists of a metallic matrix in which single gas inclusions are finely dispersed and totally enclosed by the solid. High stiffness to weight ratio, the low specific weight, the high energy absorption during plastic deformation, good mechanical strength and recyclability [1-3] are among its properties which have made them attractive for current and future applications on the automotive and construction industries among others. Aluminum foams are also good candidates for a wide range of functional applications [2]. If we consider the structural aspect of metal foams, there are three most common cell structures, namely, open cell structure, closed cell structure [1] and a combination of the two [6]. Recently, a novel structure has been developed, which is known as lotus-type growth structure [7,8]. The open cell structures incorporate interconnected pores, whereas, in closed cell structures, pores are surrounded by a metallic thin wall. The lotus-type morphology consists of long cylindrical pores aligned in one direction. Structural applications are oriented to closed cell foams while functional applications require materials with open porosity.

Techniques of development of foam

There are different ways to fabricate aluminium metal foams. One method is by injecting gas into the liquid metal. Other approaches involve the introduction of a gas or gas-release

blowing agent into the melt or producing supersaturated metal-gas solutions. Indirect methods include investment casting, the use of space filler materials and the melting of powder compacts, which contain a blowing agent. If inert gas is entrapped in powder compacts, a subsequent heat treatment can yield metal foams. The same holds for various sintering methods, metal powder slurry foaming, or extrusion and sintering of polymer/powder mixtures. Electro-deposition or metal vapor deposition also allow for the production of highly porous metallic structures [2].

Generally the techniques used by researchers are powder metallurgy and melt route method. Melt route method is effective technique for preparation of metal foam, many industries use this technique to reduce the cost of foam and use them in cost driven products. In melt route method blowing agent is added to the melt which then decomposes under the influence of heat and releases gas which then propels the foaming process.

2. Review of Literature

L.E.G. Cambronero et al. (2009) manufactured AL-Mg-Si alloy foam using natural carbonate powder and chemical calcium carbonate powder as blowing agent through powder metallurgy method. It concludes that calcium carbonates can be well utilised as foaming agent for producing foam through PM method. The density of the produced foams was between 0.53-0.56 g/cm³. The compressive strength obtained was 6.11MPa and energy absorption was 1.8kJ/m³.

M. Heidari Ghaleh et al.(2020) prepared A356 Close cell aluminium foam through melt route method only by using CaCO₃ as blowing agent. The density of the foam was ranging between 0.32 to 0.46 g/cm³ and the cell size were ranged between 1.5 to 3.1 mm. The compressive properties and energy absorption properties increases with increase in relative densities. But elastic modulus of the foamed aluminum with 3 wt% CaCO₃ (relative density = 14%) is higher than others because its cell size distribution is more homogeneous than others.

Donghui Yang et al.(2016) fabricated close cell Cu-Mg alloy foam by using powder metallurgy technique. In their study, they have taken pure Cu powder and Mg powder to fabricate foam by using CaCO₃ as blowing agent. The key in developing successful metal foam is to form an intermettalic (Mg₂Cu/MgCu₂) which should have lower melting temperature by sintering treatment. They found that the prepared foam was brittle but Mg in the foam matrix is beneficial for increasing the compressive strength.

Neu et al. [2011] studied Mg and Mg-Al alloy foams prepared by two different methods, with conventional foaming under 1 bar and pressure induced foaming. When Al is varied (0% to 17%) in the Mg melt the ductility of foam increases which in turn increases consolidation. Al was also responsible for large expansion.

Liu et al [2016] developed Al-Si-SiC composite foam by melt route method and performed the compression test at elevated temperature and found the brittle compressive behavior of foam at room temperature as well as at elevated temperatures. The material of the cell wall has significant effect on compressive properties and energy absorption characteristics, which can be obtained by adding the appropriate particles in optimum percentage into parent metal.

Choi et al [2017] studied the compression and wear behavior of freeze-cast Ti and Ti-5W alloy foams, which were further predicted by an analytical model and compared with experimental results for finding the suitability in biomedical applications.

Xia et al [2013] developed closed-cell aluminum foams via melt route method by adding Mn particle in varying percentage (0, 0.2, 1.0, 2.0 and 4.0%) and found that Mn element was uniformly distributed in the cell wall matrix which assisted in increasing the compressive strength.

Bisht and Gangil [2018] prepared Al metal foam by adding Zn particles in different weight percentage (0, 0.5 and 1%) and demonstrated a significant improvement in compression strength due to the uniform distribution of Zn particles in cell wall matrix.

Sharifi et al [2017] checked the dry sliding wear behavior of open-cell Al-Mg/Al₂O₃ and Al-Mg/SiC-Al₂O₃ composite pre-foams and found that the wear behavior depended on the density and pores per inch. The results showed that lower wear rates were obtained with smaller cell sizes and higher densities.

Suresh Kumar and O.P. Pandey [2016] prepared LM 13 alloy foams via the melt route method using pre-treated CaCO₃ at 300⁰C as blowing agent. The study was conducted for optimizing the various parameters like melt temperature, size and amount of blowing agent and stirring time for producing uniform size foams. It was observed that the distribution of blowing agent depends upon viscosity of the melt and stirring speed. In their analysis they found 875⁰C as effective foaming temperature while using 2wt% CaCO₃.

3. National and International Status

Being a new material for research it is gaining interest between researchers to utilize it in various applications as structural and functional material. A number of new metal foaming technologies have been developed in the past decade that enable a wide range of forms for this exciting material. Compared with early developments in the 1960s and 1970s, the quality of metal foams has improved, and the possibilities for making composites using it have widened. It seems quite realistic that metal foams will find real applications very soon in cars, ships, aircrafts and even spacecraft.

National Status

As it is mentioned that metal foams are very close to find realistic application, national researchers have also made some appreciable attempt in development and finding applications.

Venkat Pamidi and Manas Mukherjee:-A novel method to produce foams from metallic melts was invented. It is referred here as *melt injection* method. An apparatus to produce foams by melt injection method was also developed. In this method, bubbles are created by injecting a jet of molten metal into a pool of molten metal. These bubbles rise to the surface of melt pool and create a foam there. This method works without the need of an additional processing step to produce or add stabilising particles in the melt

Praveen K. Pinnoji , Nicolas Bourdet , Puneet Mahajan , Remy Willinger New motorcycle helmets are designed with metal foam shell and their impact behaviour were observed. Impact experiments have been performed on a first set of prototype helmets with metal foam shell at standard impact locations. The biomechanical characteristics of head impact were studied with both metal foam and ABS helmets. The helmet with metal foam shell performed reasonably well compared to ABS helmet.

Ankur Bisht and Brijesh Gangil: Aluminium metal foam was successfully prepared in Pit furnace with stirring arrangements. It reduces the cost of foam production. The method used was melt route method and bubbles were produced by using CaCO₃ as blowing agent. The foams obtained have good yield strength as well as longer plateau region in comparison to previously reported researches.

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The proposal aims to develop metal foam, which will be suitable for a structural element that possess higher compressive strength with flatter and longer plateau for energy absorption and can be utilized in moderate sliding condition. Mn, Mg and Zn can be added as the alloying element in Al to produce metal foam with desired properties. Commercial Mn granules are cheap and easy to obtain; adding an appropriate amount of Mn elements into the commercially pure Al foams could be a feasible and effective route to obtain high-strength Al foams. Zn is used in Al alloy series, which provides highest strength among other Al alloys. Mg is helpful in improving the binding strength and castability. Thus Al foam with better mechanical and sliding properties can be prepared by adding Mn, Mg and Zn as alloying elements. As per the literature review, no work is reported on the fabrication of hybrid metal foam by adding Mn, Mg and Zn in particulate form during the manufacturing process of metal foam through melt route method. The tentative material composition in tabular form is mentioned below

Designation	Composition			
	Aluminium (%)	Zinc (%)	Magnesium (%)	Manganese (%)
Foam-0	100	0	0	0
Foam-1	100	1	2	1
Foam-2	100	1	2	2
Foam-3	100	1	2	4

Selection of the proportion of the alloying elements is based on past researches. Material will be fabricated through melt route method. The fabrication procedure will have these following steps:

Step I: A certain amount of pure Al will be placed in the crucible for complete melting.

Step II: After this, 2 wt.% Ca granules will be added and stirred for 5 min at 600 rpm, but in the case when alloying elements will be added, initially stirring of Al + Ca (2 wt.%) will be done for 3 min and then followed by 2 minutes for each and every particle addition.

Step III: Then CaCO₃ will be added in the ratio of 1:100 wt.% of Al and will be stirred for 2 min at 200 rpm.

Step IV: The crucible has to be hold for a short interval of time for 5–10 s for complete expansion of foam.

Step V: Finally the crucible will be removed from the furnace and air cooled.

During the entire procedure, except for the last step, the temperature of the melt was maintained at 953±5 K.

After the successful fabrication of samples, they will be cut for physical, mechanical and tribological characterisation. The density of the samples will be measured by Archimedes principle. The fabricated samples will be cut in cubical shape for performing uniaxial compression test. The tests will be performed on universal testing machine with a pace rate of 0.2mm/s. From the stress-strain curve, energy absorption and young modulus will be calculated. The tribological test will be conducted on Pin on Disc apparatus in dry sliding condition to obtain the material's specific wear rate. Microstructure and the distribution of alloying particles in the foam will be characterized by scanning electron microscope.

5. Work Plan including timelines

The Year-wise breakup of work Plan is given below:

<u>S.No</u>	Activity	1-4	5-8	9-12
Phase 1	Literature review	←	→	
Phase 2	Procurement of raw materials		←	→
Phase 3	Development/fabrication of Metallic Foam		←	→
Phase 5	Physical and Mechanical Characterization			←

S.N.	Activity	1-4	5-8	9-12	13-16	17-20	21-24
Phase-1	Literature Review	←→					
Phase-2	Procurement of Raw Material		←→				
Phase-3	Development/ Fabrication of metal foam		←→				
Phase-4	Physical and Mechanical Characterisation			←→			
Phase-5	Tribological and Thermal Characterisation				←→		
Phase-6	Publication and Report					←→	

6. Expected Research Outcome

The prepared material will find suitable application in light weight construction where moderate sliding properties are required. Key possible outcomes are listed below:

- During the research economical aluminium metal foams will be developed successfully.
- Produced material will be light weighted and have uniform distribution of pores.
- The material will possess good yield strength and longer plateau region, which in turn will help them to enhance their energy absorption characteristic.
- It is expected that the material prepared will possess good tribological property.
- The mechanism behind the wear of materials will also be identified.

7. Expected Benefits to the Society

1. The automotive industry currently uses aluminum and its alloys to minimize the vehicle's weight that increases fuel efficiency. The prepared metallic foam will be lightweight material and about 10 times lighter than Aluminium and have the potential to replace them.
2. The vehicle weight directly impacts to CO₂ emissions, on an average, 100kg mass reduction achieved on a passenger car saves:
 - 0.35 litre of fuel per 100km
 - 9 grams of CO₂ per km at the car exhaust

Thus, with weight reduction, the fuel demand would be decreased and help to manage CO₂ emissions proportionally.

- Besides the above advantages, additional noise absorption and vibration damping benefits can also be achieved by using metallic foams.

Budget Details (Including Different Heads)

	Item	BUDGET (in Rupees)			
		1 st Year (Approximate Rate)	2 nd Year	Total	
A.	Material procurement	Aluminium 50 Kg @450/Kg	22,500/-		71,400/-
		Calcium Granules 2 kg@8000/Kg	16000/-		
		CaCO ₃ Powder 2Kg@ 1500/Kg	3000/-		
		Manganese Powder 1Kg@ 1000/Kg	1000/-		
		Magnesium Powder 2Kg@ 1500/Kg	3000/-		
		Zinc Powder 1Kg@ 400/Kg	400/-		
		Coal 500kg@30/kg	15000/-		
		Graphite Crucibles 15@ 700/Kg	10500		
			71,400/-		

B	Contingency/ Characterization	25,000/-		50,000/-	75,000/-
C	Travel/Conferences	10,000/-		20,000/-	30,000/-
D	Grand total (A+B+C)	1,06,400/-		70,000/-	1,76,400/-

8. Previous Projects Implemented by P.I:

S.No	Title of Project	Cost in Lakh	Duration	P.I. Name	Awarding Agency	Status of Project
1.	Design and Development of Biomechanical analysis of Femur bone joint	2,20,000/-	02	Ms. Anamika Bhandari, Mr. Faraz Ahamad, Dr. Brijesh Gangil	Competative Research of Technical Education Quality Improment Programme (TEQIP-III), Uttarakhand	Ongoing

9. Key Publications Published By Investigator

Publications during the last five years (2015-2020)

1. Singh, T., Patnaik, A., Gangil, B., & Chauhan, R. (2015). Optimization of tribo-performance of brake friction materials: effect of nano filler. *Wear*, 324, 10-16. SCI, Impact factor 2.9
2. Kumar, S., Gangil, B., & Patel, V. K. (2016, May). Physico-mechanical and tribological properties of grewiaoptivafiber/bio-particulates hybrid polymer composites. In AIP conference proceedings (Vol. 1728, No. 1, p. 020384). AIP Publishing LLC. Scopus Indexed.
3. Gangil, B., Kothiyal, P., & Kumar, S. (2016, May). Experimental investigation of machining process parameters in conventional turning of Al-7075 on MRR using response surface methodology. In AIP Conference Proceedings (Vol. 1728, No. 1, p. 020631). AIP Publishing LLC. Scopus Indexed.
4. Kumar, S., Gangil, B., Prasad, L., & Patel, V. K. (2017). A Review on mechanical behaviour of bast-glass fibre based hybrid polymer composites. *Materials Today: Proceedings*, 4(9), 9576-9580. Scopus Indexed.
5. Kumar, S., Kumar, Y., Gangil, B., & Patel, V. K. (2017). Effects of agro-waste and bio-particulate fillers on mechanical and wear properties of sisal fibre based polymer composites. *Materials Today: Proceedings*, 4(9), 10144-10147. Scopus Indexed.

6. Singh, T., Chauhan, R., Patnaik, A., Gangil, B., Nain, R., & Kumar, A. (2018). Parametric study and optimization of multiwalled carbon nanotube filled friction composite materials using Taguchi method. *Polymer Composites*, 39(S2), E1109-E1117. SCI, Impact factor 2.0
7. Bisht, A., & Gangil, B. (2018). Structural and physico-mechanical characterization of closed-cell aluminum foams with different zinc additions. *Science and Engineering of Composite Materials*, 25(4), 789-795. SCI, Impact factor 0.8
8. Tejyan, S., Singh, T., Patnaik, A., Fekete, G., & Gangil, B. (2019). Physico-mechanical and erosive wear analysis of polyester fibre-based nonwoven fabric-reinforced polymer composites. *Journal of Industrial Textiles*, 49(4), 447-464. SCI, Impact factor 1.7.
9. Kumar, S., Patel, V. K., Mer, K. K. S., Fekete, G., Gangil, B., & Singh, T. (2018). Influence of woven bast-leaf hybrid fiber on the physico-mechanical and sliding wear performance of epoxy based polymer composites. *Materials Research Express*, 5(10), 105705. SCI, Impact factor 1.44.
10. Singh, T., Patnaik, A., Fekete, G., Chauhan, R., & Gangil, B. (2019). Application of hybrid analytical hierarchy process and complex proportional assessment approach for optimal design of brake friction materials. *Polymer Composites*, 40(4), 1602-1608. SCI, Impact factor 2.0.
11. Singh, T., Gangil, B., Patnaik, A., Kumar, S., Rishiraj, A., & Fekete, G. (2018). Physico-mechanical, thermal and dynamic mechanical behaviour of natural-synthetic fiber reinforced vinylester based homogenous and functionally graded composites. *Materials Research Express*, 6(2), 025704. SCI, Impact factor 1.44.
12. Nadda, R., Kumar, R., Singh, T., Chauhan, R., Patnaik, A., & Gangil, B. (2018). Experimental investigation and optimization of cobalt bonded tungsten carbide composite by hybrid AHP-TOPSIS approach. *Alexandria engineering journal*, 57(4), 3419-3428. SCI, Impact factor 1.2.
13. Singh, T., Gangil, B., Patnaik, A., Biswas, D., & Fekete, G. (2019). Agriculture waste reinforced corn starch-based biocomposites: effect of rice husk/walnut shell on physicomachanical, biodegradable and thermal properties. *Materials Research Express*, 6(4), 045702. SCI, Impact factor 1.44.
14. Kumar, S., Mer, K. K. S., Gangil, B., & Patel, V. K. (2019). Synergy of rice-husk filler on physico-mechanical and tribological properties of hybrid Bauhinia-vahlilii/sisal fiber reinforced epoxy composites. *Journal of Materials Research and Technology*, 8(2), 2070-2082. SCI, Impact factor 5.1.
15. Gairola, S., Joshi, A., Gangil, B., Rawat, P., & Verma, R. (2019). Correlation of tensile properties and fracture toughness with microstructural features for Al-Li 8090 alloy processed by cryorolling and post-rolled annealing. *Transactions of the Indian Institute of Metals*, 72(7), 1743-1755. SCI, Impact factor 1.3.

16. Kumar, S., Patel, V. K., Mer, K. K. S., Gangil, B., Singh, T., & Fekete, G. (2019). Himalayan natural fiber-reinforced epoxy composites: Effect of *grewiaoptiva/bauhinia vahlii* fibers on physico-mechanical and dry sliding wear behavior. *Journal of Natural Fibers*, 1-11. SCI, Impact factor 2.4.
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18. Singh, T., Gangil, B., Singh, B., Verma, S. K., Biswas, D., & Fekete, G. (2019). Natural-synthetic fiber reinforced homogeneous and functionally graded vinylester composites: Effect of bagasse-Kevlar hybridization on wear behavior. *Journal of Materials Research and Technology*, 8(6), 5961-5971. SCI, Impact factor 5.1.
19. Verma, S. K., Gupta, A., Singh, T., Gangil, B., Jánosi, E., & Fekete, G. (2019). Influence of dolomite on mechanical, physical and erosive wear properties of natural-synthetic fiber reinforced epoxy composites. *Materials Research Express*, 6(12), 125704. SCI, Impact factor 1.44.
20. Kumar, S., Mer, K. K. S., Gangil, B., & Patel, V. K. (2020). Synergistic effect of hybrid Himalayan Nettle/*Bauhinia-vahlii* fibers on physico-mechanical and sliding wear properties of epoxy composites. *Defence Technology*, 16(4), 762-776. SCI, Impact factor 1.5.
21. Singh, T., Pruncu, C. I., Gangil, B., Singh, V., & Fekete, G. (2020). Comparative performance assessment of pineapple and Kevlar fibers based friction composites. *Journal of Materials Research and Technology*, 9(2), 1491-1499. SCI, Impact factor 5.1.
22. Bisht, A., Gangil, B., & Patel, V. K. (2020). Selection of blowing agent for metal foam production: A review. *Journal of Metals, Materials and Minerals*, 30(1). ESCI.
23. Khare, J. M., Dahiya, S., Gangil, B., & Ranakoti, L. (2020). Influence of different resins on Physico-Mechanical properties of hybrid fiber reinforced polymer composites used in human prosthetics. *Materials Today: Proceedings*. Scopus Indexed.
24. Gairola, S. P., Tyagi, Y. K., Gangil, B., & Sharma, A. (2020). Fabrication and mechanical property evaluation of non-woven banana fibre epoxy-based polymer composite. *Materials Today: Proceedings*. Scopus Indexed.
25. Ravi Gupta, Kamlesh Kushwah, Sanjay Goyal, Brijesh Gangil, Ankush Sharma. (2020). Ramie-glass fiber reinforced epoxy composites: Impact of walnut content on mechanical and sliding wear properties. *Materials Today: Proceedings*. Scopus Indexed.
26. Tejyan, S., Sharma, D., Gangil, B., Patnaik, A., & Singh, T. (2020). Thermo-mechanical characterization of nonwoven fabric reinforced polymer composites. *Materials Today: Proceedings*.

27. Gupta, A., Joshi, A., Tejyan, S., Gangil, B., & Singh, T. (2020). Comparative study of mechanical properties of orange peel filled epoxy composites joined by a mechanical fastener. *Materials Today: Proceedings*.

10. Detailed CV of PI:

Attached

12. Name and address of two experts in the area of the proposal

1. Dr. Amar Patnaik

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5. Zhao YY, Sun DX. *Scr. Mater.* 2001, 44, 105–110.

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9. Yang, Donghui, et al. "Fabrication of Mg-Al alloy foam with close-cell structure by powder metallurgy approach and its mechanical properties." *Journal of Manufacturing Processes* 22 (2016): 290-296.
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12. Choi, Hyelim, et al. "Study of the compression and wear-resistance properties of freeze-cast Ti and Ti–5W alloy foams for biomedical applications." *Journal of the Mechanical Behavior of Biomedical Materials* 72 (2017): 66-73.
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15. Sharifi, Hassan, et al. "Dry sliding wear behavior of open-cell Al-Mg/Al₂O₃ and Al-Mg/SiC-Al₂O₃ composite preforms produced by a pressureless infiltration technique." *Tribology International* 116 (2017): 244-255.
16. Kumar, Suresh, and O. P. Pandey. *Development of Aluminium Composite and its Foams for Mechanical Applications*. Diss. 2016.
17. Pamidi, Venkat, and Manas Mukherjee. "Melt injection—A novel method to produce metal foams." *Materialia* 4 (2018): 500-509.
18. Pinnoji, Praveen K., et al. "Impact dynamics of metal foam shells for motorcycle helmets: Experiments & numerical modeling." *International journal of impact engineering* 37.3 (2010): 274-284.
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(A Central Univeristy)

हे0न0ब0ग0वि0वि0/आर0सी0सी0/2021/755

दिनांक 26-07-2021

कार्यालय आदेश (755/2021/)

शोध एवं परामर्श समन्वय प्रकोष्ठ (RCC Cell) द्वारा विश्वविद्यालय में शोध परख गतिविधियों के प्रोत्साहन एवं विकास हेतु संकाय सदस्यों के लिए प्रारम्भ की गई लघु शोध परियोजना (Minor Research Project for Faculties) योजना अन्तर्गत संकाय सदस्यों से प्राप्त शोध प्रस्तावों की समीक्षा एवं जाँच तथा इन शोध प्रस्तावों पर संकाय सदस्यों द्वारा समिति के समक्ष किये गये प्रस्तुतीकरण के आधार पर समिति की संस्तुतियों पर कुलपति जी के अनुमोदनोपरान्त शैक्षिक सत्र 2021-22 से दो शैक्षिक सत्रों के लिये लघु शोध परियोजना निम्न संकाय सदस्यों को संलग्न शर्तों के आधार पर आवंटित करने की स्वीकृत प्रदान की जाती है।

(A) School of Science

- | | |
|-------------------------------|------------------------|
| 1. Dr. Indrashis Bhattacharya | Deptt of Zoology |
| 2. Dr. Subra Kala | Deptt of Physics |
| 3. Dr. Brijesh Gangil | Mechanical Engineering |

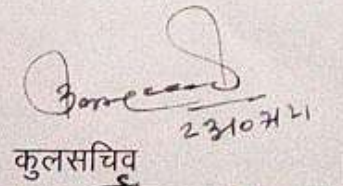
(B) School of Humanities and Social Science

- | | |
|-------------------------|-----------------------------|
| 1. Dr. Hira Lal Yadav ✓ | Deptt of Physical Education |
| 2. Dr Vishal Guleria | Deptt. of Law |
| 3. Dr. R.S. Negi | Deptt. of Political Science |

आज्ञा से
कुलपति

प्रतिलिपि:- निम्नलिखित के सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. उक्त सम्बन्धित को।
2. समस्त संकायाध्यक्ष/विभागाध्यक्ष
3. वित्त अधिकारी।
4. निजी सचिव कुलसचिव।
5. निजी सचिव कुलपति, कुलपति महोदया के सादर सूचनार्थ।


23/07/21
कुलसचिव

HNB Garhwal University, Srinagar (Garhwal), Uttarakhand Research and Consultancy Co-ordination Cell

Name of the PI: Dr.Hiralal Yadav

Current Post:Assistant Professor

Department: Physical Education

School: Education

Campus: Srinagar

Corresponding Address: Department of Physical Education, Birla Campus, HNBGU, Srinagar Garhwal, Uttarakhand

Date of Birth:08.08.1982

Date of Joining:20.06.2013

Number of Ph.D. students Registered with PI:02

Number of Ph.D. Awarded: 0

Broad Area of Expertise of PI:

- Physiological responses and recovery pattern of Athletes
- Psychological Profile of the All India Inter-University level athletes.
- Health and Well-being for Society
- Physical Fitness, Health related Fitness and Mental Health
- Training and Exercise for sports performance
- Pyscho- Physiological Profile of Sports Persons.
- Physical activity and exercise for healthy living.
- Exercise addiction and combating lifestyle disease and disorder.

HNB Garhwal University, Srinagar (Garhwal), Uttarakhand

Research and Consultancy Co-ordination Cell

Format for Submitting the Project Proposal

Project Title:- “Evaluation on Health related Physical Fitness and Nutritional status of School children of Garhwal Uttarakhand”

1. Introduction of the proposal (Max 500 words)

The modern period is a period of competition. In this period, every individual has the challenge to be physically as well as mentally fit in all aspects to survive against adverse conditions and several difficulties that arise in daily life. Physical fitness is a great tool for every individual to fight against their competitors. Human life is based mainly upon the body, as the body is the medium of every effort that every individual tries. All the activities of life are done with the coordination of mind and the body. Nature has created human being to perform numerous activities efficiently. Physical activity is the inherent requirement of the human body, lack of it will have ill effects on physical, mental & social aspect of human life. **The World Health Organization defines (1948) the Health “A state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity.”**

In India, these days children are becoming far less active as they move through adolescence and it is found that obesity is increasing among children. All these findings indicate that current Physical education programs are inadequate to promote lifetime Physical Fitness. These findings have made Physical educators realize that a change in curriculum is needed which would lead to development of attitude towards lifelong exercise behaviour with special emphasis on Health Related Physical Fitness. The definition of Physical Fitness might vary by individually but most experts agree that there are five basic components of Physical Fitness which involve our heart, lungs, strength, endurance, and agility or flexibility. The Health Related Physical Fitness can be determined by how well the body performs in each one of the components of physical fitness as a whole, Cardiovascular Endurance, Muscular Endurance, Muscular Strength, Flexibility and Body Composition.

Many recent studies have underlined the risks of excessive energy intake and sedentary lifestyle in young adults, which can be associated with the increased prevalence of dyslipidemia, obesity, and cardiovascular diseases (CVD). Particularly, sedentary lifestyle (e.g., playing computer games) is associated with unhealthy snacking patterns, including low intake of fruits and vegetables and overconsumption of energy and fat. The development of children into healthy adults is dependent on their growing, starting from their antenatal period, in a healthy environment and having balanced nutrition. Today, the majority of the avoidable infant and child mortalities results from malnutrition. The most prevalent effect of poverty on children is under nutrition. Poverty is a key determinant of under nutrition, through the unhealthy physical environment, domestic stress and fatigue-related early stopping of the mother’s milk also contributes to malnutrition along with the lack of education of mothers.

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WHO estimates that, in the world, 27 percent of the children fewer than five years of age have less than the normal weight-for-age, and that most of these children live in the developing countries. Nutrition of primary school children determines their life time health, strength and intellectual vitality. This span of life is a dynamic stage of physical growth and mental development. But still now in India, the position of health and nutritional status of the school-age children are not satisfactory level. The national family health survey (NFHS-4) data reported that 37.5% of children were underweight in India out of which 29.1% in urban and 38.3% in rural and it varies across the states. There are no any other efforts to supplementary feeding program for school children in age group 5-14 years except mid-day meal programme.

In India, no national-level data exist on the nutritional status of schoolchildren. However, some local studies suggest high prevalence rates of stunting, underweight, wasting, and anemia and deficiencies of several micronutrients in this age group. Most studies assessing the micronutrient status of schoolchildren in developing countries have only evaluated one micronutrient or a few micronutrients, making it difficult to assess the extent of multiple deficiencies among this age group in a given population. This limits the ability of policy makers to develop effective interventions to address the problem, since there is evidence that multiple micronutrient deficiencies coexist and interact in developing countries. Therefore, to develop effective interventions to address malnutrition among schoolchildren in India, a sound understanding of the extent, distribution, and determinants of nutritional deficiencies in the school-age population is essential.

Therefore, the proposal aims mainly to gain new insight and first-hand information on the health related Physical fitness and nutritional status of school children of Garhwal region of Uttarakhand and also develop a relationship between health related physical fitness with their nutritional status.

2. Review of Literature (Max 1 page)

Samaneh Hosseini et.al (2019) studied that Nowadays, sedentary lifestyle has been introduced as a major challenge to human health. Thus, exercise and physical activity, followed by physical fitness, have been emphasized as low cost methods. The aim of this study was to evaluate physical activity and physical fitness among adolescents. Method: This study was of descriptive-analytic type that evaluated the physical fitness of 550 high school students in Rasht city in the year 1395. The samples were selected by random and two-stage cluster sampling methods. Data gathering tool was Inventory individual and four health related fitness tests. Data analysis was done using descriptive statistics and logistic regression test with Backward LR method in SPSS-22 software. Results: Overall, the results revealed a moderate level of physical fitness among students. Girls had a higher mean score in terms of flexibility, BMI (body mass index) and cardiovascular fitness compared to boys. The type of school was the only variable able to predict students' physical fitness ($\beta = 0.333$) and ($p = 0.023$). Conclusion: Since most of the students had poor physical fitness, it is recommended

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to pay more attention to their sports and health program in schools. (Journal of Advanced Pharmacy Education & Research · July 2019)

Jadon Jairaj Singh, 2018 study was to compare the Health Related Physical Fitness among students of dissimilar schools in western Uttar Pradesh. This study was conducted on Eight hundred (800) subjects with their age range between 14-18 years. 200 subjects from each dissimilar of schools, i.e. Kendriya Vidyalaya (KV), Jawahar Navodaya Vidyalaya (JNV), Government Inter College (GIC) and Private School (PVT) were selected on the basis of random sampling. In the current exploration standardized tests and procedures were used. To assess the HRPF components; the data pertaining to Cardiovascular Endurance, Muscular Endurance, Muscular Strength, Body composition and Flexibility were measured by 12 minute Cooper run/walk test, Bent knee sit-ups, Hand Grip Strength Test, BMI and Sit & Reach test respectively. The results of the study were, Cardiovascular Endurance of GIC students was found highest in comparison to other schools. Cardiovascular endurance of JNV students was found lower to GIC students, but higher to KV Students. Cardiovascular Endurance of PVT students was found lowest. Muscular Strength of PVT students was found lower to GIC students, but higher to JNV Students. Muscular Strength of KV students was found lowest. Body Composition of PVT students was found highest in comparison to other schools.

Akoto Osei et al (2010) studied on Nutritional Status of Primary Schoolchildren in Garhwali Himalayan Villages of India. A random sample of 499 children 6 to 10 years of age from 20 public primary schools was selected. Household socio demographic data and morbidity data on children were collected through interviews with their caretakers. Height and weight were measured, and venous blood was drawn for assessment of hemoglobin, serum ferritin, soluble transferrin receptor, retinol, zinc, folic acid, vitamin B₁₂, and C-reactive protein. Stool samples were analyzed for parasitic infections. Underweight, stunting, and wasting were present in 60.9%, 56.1%, and 12.2% of schoolchildren, respectively. Anemia, iron-deficiency anemia, and low serum concentrations of ferritin, zinc, retinol, folate, and vitamin B₁₂ were found in 36.7%, 10.2%, 24.1%, 57.1%, 56.1%, 67.9%, and 17.4% of the children, respectively. One-fifth of the children had intestinal parasites. Being underweight was associated with lower household wealth ($p < .05$). Helminth infection was associated with stunting, anemia, and low serum retinol ($p < .05$). Living at higher altitude was associated with low serum levels of ferritin, retinol, and vitamin B₁₂. There were no associations between any socio demographic variables and serum zinc or folate. Growth impairment and micronutrient deficiencies are prevalent among schoolchildren in Himalayan villages of India. (First Published June 1, 2010 Research Article Find in PubMed <https://doi.org/10.1177/156482651003100205>)

Madhur Verma and et. al (2020) conducted a study on Nutrition Status of School Children in Punjab, India: Findings from School Health Surveys. The study depicts a high level of under nutrition in school-going children and adolescents. There is a need to strengthen the nutrition interventions for middle childhood and adolescence period that can

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help in a healthy transition from childhood to adulthood and break the intergenerational cycle of malnutrition. study depicts a high level of under nutrition in school-going children and adolescents. We found that girls were affected more by malnutrition in middle childhood, i.e. during 5-9 years (both by stunting and thinness) compared to boys. But in middle and late adolescence, males were more stunted and thin compared to females. Programs to support adolescents' nutrition interventions could provide an opportunity for a healthy transition from childhood to adulthood and could be an essential step in breaking the intergenerational cycle of malnutrition. (<https://pubmed.ncbi.nlm.nih.gov/33130876/>, J Trop Pediatr)

National and International Status (Max 1 page):-

Anupama Karkera and et.al (2014) conducted a study on Physical Fitness and Activity Levels among Urban School Children and their Rural Counterparts, and revealed that rural children performed better in flexibility and cardio vascular endurance tests when compared to their urban counterparts. Promotion of health related fitness involves physical activity associated with weight management which is the prime need of the hour. (published in The Indian Journal of Pediatrics volume 81, pages356–361)

Nehal Patel, and et. al (2015) studied on Nutrition and health status of school children in urban area of Ahmedabad, India: Comparison with Indian Council of Medical Research and body mass index standards a multi-center prospective study to evaluate the nutritional and health status of school going children by physical examination and anthropometric measurements. (published in J Nat Sci Biol Med. ; 6(2): 372–377)

Madhur Verma and et. al (2020) conducted a study on Nutrition Status of School Children in Punjab, India: Findings from School Health Surveys. The study depicts a high level of under nutrition in school-going children and adolescents. There is a need to strengthen the nutrition interventions for middle childhood and adolescence period that can help in a healthy transition from childhood to adulthood and break the intergenerational cycle of malnutrition. study depicts a high level of under nutrition in school-going children and adolescents. We found that girls were affected more by malnutrition in middle childhood, i.e. during 5-9 years (both by stunting and thinness) compared to boys. But in middle and late adolescence, males were more stunted and thin compared to females. Programs to support adolescents' nutrition interventions could provide an opportunity for a healthy transition from childhood to adulthood and could be an essential step in breaking the intergenerational cycle of malnutrition. (<https://pubmed.ncbi.nlm.nih.gov/33130876/>, J Trop Pediatr)

Akoto Osei, and et.al studied on Nutritional Status of Primary Schoolchildren in Garhwali Himalayan Villages of India and found out that Growth impairment and micronutrient deficiencies are prevalent among schoolchildren in Himalayan villages of India (.First Published June 1, 2010 Research Article Find in PubMed <https://doi.org/10.1177/156482651003100205>)

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Research and Consultancy Co-ordination Cell

Hazzaa M. Al-Hazzaa (2002) studied on Physical activity, fitness and fatness among Saudi children and adolescents, Implications for cardiovascular health, Saudi Med J; Vol. 23 (2) Based on the available evidences, promotion of physical activity among Saudi children and adolescents appears warranted and national policy encouraging active living is also needed.

Saikot Chatterjee et.al. (2014) studied on Relationship between Nutrition status and Physical fitness of school going boys, The past three decades have witnessed the emergence of over nutrition as a problem in school-age children in developed countries and in affluent urban segments in developing countries. The main determinants of performance are physical fitness and skill. Longitudinal studies have shown that the lifestyle and physical fitness during childhood and adolescence were major determinants of lifestyle, physical fitness and freedom from non-communicable diseases in adult life. *IOSR Journal of Sports and Physical Education (IOSR-JSPE)* e-ISSN: 2347-6737, p-ISSN: 2347-6745, Volume 1, Issue 5 (), PP 46-50 www.iosrjournals.org www.iosrjournals.org)

3. Proposed Objectives:-

- To find out the level of Health Related Physical Fitness of the Govt. School Male and Female students of Garhwal region of Uttarakhand state.
- To find out the Nutritional status of the Govt. School Male and Female students of Garhwal region of Uttarakhand state.
- To compare the health related physical fitness and nutritional status among male and female govt, school students of Garhwal region of Uttarakhand state.
- To find out the relationship between health related physical fitness and Nutritional status of govt, school male and female students of garhwal region of Uttarakhand state.

4. Workplan including timelines

The Purpose of the research project is to evaluate the Health Related Physical Fitness and Nutritional of School children of Garhwa region of Uttarakhand. The subject will be from three district of Garhwal region i.e. Chamoli, Rudraprayag and Pauri. Further the data will be taken from the govt. schools of block head quarters of these three district namely Chamoli, Rudraprayag and Pauri. The subjects will be taken by using purposive random sampling technique/method. The subject for the project will be selected in two categories boys and girls from govt Schools of each Block head quarters. For this study total 1000 subjects will be taken from both categories. The subjects from 03 districts of Garhwal mandal i.e. Chamoli, Rudraprayag and Pauri of Uttarakhand state will be taken. .From **Chamoli District:** Dasholi, Joshimath, Ghat, Pokhari, Karanprayag, Gairsain, Narayanbagarh, Tharali and Dewal; **Rudraprayag District:-** Augustmuni, Jakholi and Ukhimath; **Pauri District:-** Pauri, Kat, Kaljikkhal, Khirsu, Pabo, Thalishain, Birokhal, Nainidanda, Ekeshwar, Pokhari, Rikhanikkhal, Jaiharikkhal, Dhwarikkhal, Dugadda, Yamkeshwar From each selected district and govt. schools selected 1000 boys and girls students belonging to 14-16 years of age will

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Research and Consultancy Co-ordination Cell

be taken for the project work.50 students(boys &girls) from each govt, schools of each block head quarter will be taken for collection of data.

For the purpose of the project work the following variables will be taken:

1- Health related physical fitness:

- Cardiovascular Endurance- Cooper's 12 minute run walk test. The scores will be recorded in miles / kilometres.
- Muscular endurance- Bend Knee Sit Ups Test. The scores will be recorded in Number
- Muscular Strength- Leg and back dynamometer, score will be recorded in kilogram (kg).,Modified push-ups continuously for 40 second, the scores will be recorded in numbers.
- Flexibility- Sit and Reach Test. The scores will be recorded in c. m. / Inches.
- Body Composition- Skinfold Caliper./digital body composition analyser

2- Nutritional Status:-

The Nutritional status of the subject will be assessed by taking data on Height, weight , waist circumference, hip circumference , middle upper arm circumference. The data on above mentioned anthropometric measurement will be derives on BMI and WHR and based on the standard norms the nutritional status of school children will be interpreted.

Data Collection

To collect data as par the requirement, the PI will take prior permission from the Govt. School Education Board to collect the data from the selected districts of Garhwal region of Uttarakhand state and will select the sample of students both male and female of 14-16 years of age by using stratified Random Sampling technique. The subjects will be instructed regarding the Health Related Physical Fitness Test and Nutritional status and Tests of physical fitness components and anthropometric measurements will be administered on the Sample to get the required data. The raw data will be tabulated by applying adequate statistical techniques. The project work will be completed in stipulated time period.

5. Expected Research Outcomes (Max 250 Words)

Despite the well-known importance of nutritional health several cultural, social, political, economic and educational factors contribute to malnutrition among children School going children constitute one-fifth of the total population and are the future of the nation. The health supervision of the school children is necessary and can help identify the magnitude of morbidity and malnourishment in a community. Nehal Patel et al. (2015),School-going children and adolescents are rarely targeted in nutrition surveys, despite the significant impact of nutritional status on their health, cognition, educational achievements and future economic productivity. Madhur Verma et al.(2020).

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Because school-age children undergo a period of rapid growth, nutrient deficiencies at this age can lead to retarded growth, anaemia, reduced immune function, and impaired motor and cognitive development, all of which may adversely affect academic performance through reduced learning capacity and poor school attendance. Since there is no concrete method adopted for measuring the health indicators and nutrition status of school going children in the government schools in the Uttarakhand state, it becomes very difficult for parents and government agencies to keep eye on their growth and development. Little or no sports activities in the limited outdoor space available in the remotely situated schools in hill region makes thing more complicated for the young students. Health related fitness measurement is allows to get first-hand information about individual's overall health status and could be attributed to his nutritional condition.

The previously conducted studies were mainly focussed upon infant mortality rate or primary school children as a major health indicator for children in the state. This study is planned to assess the nutritional status and Health related Fitness of school children in Himalayan villages of India and to determine the relationships between their Health-related fitness and nutritional status. The result of the study shall surely be useful for making new steps in planning for talent identification process in the field of sports and also work out the strategy for government to bring out plans for the under nourished children.

6. Expected Benefits to the Society (Max 250 words)

Uttarakhand is a predominantly rural state with 16,826 rural settlements, of which 12,699 or 81% have a population of less than 500. In most of the districts, more than 75-85 % of rural settlements have a population of less than 500. The population of the districts in Uttarakhand varies considerably. Four of the 13 districts, namely Dehradun, Haridwar, Udham Singh Nagar and Nainital account for 61.5 % of the state's total population. On adding Tehri Garhwal, Pauri Garhwal and Almora, this accounts for nearly 81%. This clearly shows that the concentration of population is quite high in the mid and foothills as compared to the remaining six districts of high hills.

Less density in the population may be attributed to poor health and education facilities in those areas. Rural migration has caused a drastic shift in the socio-economic structure of Uttarakhand state. The population left in those remotely connected and meagrely served areas are majorly dependent upon government schemes related to health and education without much choice. In the recent times, Uttarakhand state government has initiated sports promotion program like- 'Khel Mahakumbh' which provides opportunity to the talented youth studying in the less privileged area/ institutes of the state to participate and win big. These kinds of initiatives can only be beneficial to the society, when we engage young students with regular physical activity programs and nutritional support. The data and results of this

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study may be utilized for planning a long-term objective of healthy and educated society.

7. Budget Details (Including Different Heads)

Heads of Expenditure	Number	Months	Rate/Month (Rs)	Amount (Rs)
1. Research Staff				0
(a) Research Associate			0	0
(b) Research Assistant	01	12	8000	96000
(c) Field Investigator				
2. Field Work	NA	NA	NA	0
3. Equipment and Study Material Skin Fold Caliper for Body Composition Sit and Reach test box for Flexibility Back and Leg dynamometer Digital Body composition analyser, Anthropometric kit	NA	NA	NA	40000
4. Contingency	NA	NA	NA	64000
5. Workshops/Seminars as part of the Study	NA	NA	NA	0
Sub-Total (Rs)				200000
6. Institutional overheads	NA	NA	NA	0
Total (Rs)				200000

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Budget Justification of different heads of budget:

1. Research Staff :

One research Assistant will be required for the data collection as well as compilation of the data and maintenance of the instruments. Due to limitation of the Budget the Research assistant will be there for a period of one year duration.

2. Equipment and study material :

It is necessary to purchase certain Health related Physical Fitness equipments in order to collect the data on the selected variables namely Digital Body composition analyser /Skin Fold Calliper for Body Composition, Sit and Reach test box for Flexibility, Back and Leg dynamometer for muscular strength measurements and anthropometric kit for anthropometric measurements.

3. Contingency: Contingency grant will be used for data collection procedure, stationary, printing and other miscellaneous expenditure during the execution of the Project.

8. Previous Projects Implemented by PI NA

S. No	Title of the Project	Cost in Lakh	Duration	PI Name	Awarding Agency	Status of Project
	NA					

9. Key publications published by the Investigator during the last 5 years


- Dr. HiralalYadav , PHYSIOLOGICAL EFFECT OF 800MTS AND 1500MTS DISTANCE RUNNING ON HEART RATEJournal Name:- SODHA PRERAK ISSN:-2231-413X Vol.VI Issue 1 January 2016
- Dr. Hiralal Yadav Lactate Threshold and Maximum Oxygen Consumption (VO2MAX) , VAICHARIKI ISSN 2249-8907, Vol. VI, Issue 1, March 2016.
- Dr. Hiralal Yadav A comparative study on recovery pattern of 5000mts and 10,000mts distance runners , Shaikshank Shodh, A refereed Research Journal Vol.01 Issue: 01 , Dec 2016.
- Dr. Dalveer Singh Kaunteya, and Dr. HiralalYadav , Relationship of pace and selected physical variables in middle distance running, International Journal of Yogic, Human Movement and Sports Sciences 2018; 3(2): 152-154
- Dr. Dalveer Singh Kaunteya, and Dr. HiralalYadav, RELATIONSHIP OF PACE AND HEART RATE IN MIDDLE DISTANCE RUNNING Journal Name:- Sambodhi (UGC care Journal) ISSN:2249-6661 Vol.43 No.04(XI) October-December(2020)

HNB Garhwal University, Srinagar (Garhwal), Uttarakhand Research and Consultancy Co-ordination Cell

- Dr. Hiralal Yadav, and Dr. Dalveer Singh Kaunteya, RELATIONSHIP OF PACE AND BLOOD LACTIC ACID AMONG MIDDLE DISTANCE RUNNERS Journal Name:- Sambodhi (UGC care Journal) ISSN:2249-6661 Vol.43 No.04(XI) October-December(2020)

10. Detailed CV of the PI

CURRICULUM VITAE

	<p>Dr. Hiralal Yadav Assistant Professor , Dept. of Physical Education, HNBGU, Srinagar , Garhwal , Uttarakhand Pin-246174 Ph.No.01346-252451 Mob:8171384451,8859500660 E.Mail:-hiralal08@gmail.com</p> <p>Permanent Address: Road No:- 7, , Near Bed Loyola College, Sadhudera, Birsanagar, Zone No:- 1B Jamshedpur Jharkhand Pin- 831019</p>
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PROFESSIONAL QUALIFICATIONS

- AISSE Examination (10th) from Vidya Bharati Chinmaya Vidyalaya (C.B.S.E.), Jamshedur, Jharkhand and Secured 79.4 %.
- AISSCE Examination (10+2) from Vidya Bharati Chinmaya Vidyalaya (C.B.S.E.), Jamshedur, Jharkhand and Secured 74.4 %.
- Bachelor of Physical Education from L.N.I.P.E.(Deemed University) Gwalior and secured 72.4% marks in the year 2005
- Master of Physical Education from L.N.I.P.E. (Deemed University) Gwalior and secured 77.33% marks in the year 2007.

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Research and Consultancy Co-ordination Cell

- Doctor of Philosophy in Physical Education (PhD) from L.N.U.P.E, Gwalior in the year 2010.

PROFESSIONAL EXPERIENCES

- Passed Federation Technical Official Examination organized by Athletic Federation of India, New Delhi.
- Passed International Association of Athletic Federation (IAAF) Level-I Examination for Technical Officials.
- Acted as a Technical Official in CWG-2010, Delhi , India
- Acted as Technical Official in the Asian Athletics Championship- 2013 Pune, India.
- Acted as a Technical Official in Pune International Marathon.
- Acted as a Technical Official in Khelo India Youth Games in the Year 2019 at Pune Maharastra.

DEGREE AND HONOURS AWARDS

- ❖ Awarded **Junior Research fellowship** (JRF) and cleared eligibility for lectureship (NET) examination in year 2007.
- ❖ Awarded the Degree of Bachelor of Physical Education with specialization in Track & Field.
- ❖ Awarded the Degree of Master of Physical Education with specialization in Track & Field.
- ❖ Awarded the Degree of Doctor of Philosophy in Physical Education.
- ❖ Awarded with **Gold medal** in Bachelor of Physical Education.
- ❖ Awarded with **Gold medal** in Master of Physical Education.

FELLOWSHIP & SCHOLARSHIP AWARDED

- ❖ Awarded Junior Research Fellowship(JRF) from 01.08.2007 to 31.07.2009 and Senior Research Fellowship(SRF) from 01.08.09 to 31.05.2010 by UGC.

RESEARCH EXPERIENCE

- ❖ Competed A Project on “ Historical Development of Pole Vault”
- ❖ Completed Thesis on “Comparison of Aerobic and Anaerobic Capacity of Sprinters, Jumpers and Throwers”.
- ❖ Completed PhD Thesis on “ Physiological Responses and Recovery Pattern of Long Distance Runners.

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Research and Consultancy Co-ordination Cell

BOOKS/CHAPTER IN BOOK

- ❖ Chapter written in Diet And Nutrition For Sporting Performance, Quality Of Life : Harmony Between Mind And Body, Ebong Prantik, Bhagwanpur, BHU, Varanasi, U.P.(2015)ISBN No.:-978-93-85454-01-1
- ❖ Book published with title “Physiological Responses and Recovery Pattern in Athletics”, Sports Publication , Delhi (2020) ISBN No.:-978-93-90016-54-9

REFRESHER/ORIENTATION COURSE/ WORKSHOP ATTENDED

- Attended Advance training programme on SPSS organized by Department of Statistics, School of Science , HNB Garhwal University , Srinagar, Garhwal Uttarakhand held on 30-31 January 2014.
- Attended UGC Sponsored Orientation Programme at UGC Academic Staff College , LNIPE , Gwalior M.P. India between 2-29 Sept 2014.
- Attended Refresher course from 15/09/2016 to 05/10/2016 at UGC-HRDC, LNIPE, Gwalior
- Attended Short term course from 04/09/2017 to 09/9/2017 at Academic Activity Centre Chauras campus organised by FDC, HNBG University, Uttrakhand.
- Attended One week Workshop on Developing scientific temperament in physical education teaching through innovative learning, 02-07 April 2019, organized by School of Education, PMMMNMTT, H.N.B.G. University, Srinagar Garhwal,Uttarakhand. Participated as **Organizing Secretary** .
- Attended Refresher course from 26/10/2020 to 09/11/2020 at UGC-HRDC, LNIPE,Gwalior

RESEARCH PAPER PUBLISHED IN NATIONAL AND INTERNATIONAL JOURNALS

1. Śodha Pravāha, Biomechanical Analysis of Head Load Impact on Posture of The Forest Dependent People of Uttarakhand State. ISSN 2231-4113, Vol. III, Issue 3, July 2013 150.
2. Journal of Physical Education and allied Sciences with topic entitled “COMPARISON OF MAXIMUM OXYGEN CONSUMPTION (VO₂ Max.) OF 5000m and 10000m DISTANCE RUNNERS” ISSN 2230-7397 January 2014.
3. Journal of Physical Education and sports Sciences (NJPESS-2014) with topic entitled “A study on Physiological and Biochemical Responses of Long Distance Runners ”, ISSN: 2348 – 4713 Vol. 1, Issue 1.
4. PERSIST A Referred Research Journal, Journal of Physical Education, Recreation and Sports in Science and Technology. Volume VI No.1 June 2014 ISSN:0975-7414

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with Topic Entitled “Blood Lactate Response and Recovery Pattern of 5000m and 10,000m Distance Runners”.

5. A Refereed Journal SHODH PRERAK with topic entitled “Physiological Effect of 800mts And 1500mts Distance Running on Heart Rate”. ISSN 2231-413X, Vol. VI, Issue 1, January 2016.
6. A Refereed Journal VAICHARIKI with topic entitled “Lactate Threshold and Maximum Oxygen Consumption (VO₂MAX)” ISSN 2249-8907, Vol. VI, Issue 1, March 2016
7. International Journal of Physical Education, Health and Social Science (IJPEHSS) with topic entitled “Comparative study of Emotional Intelligence between coaches of selected sports”, ISSN: 2278 – 716X Vol. 2, Issue 2.
8. International Educational E-Journal, {Quarterly}, Lactate Dehydrogenase (LDH) Responses of Long Distance Runners under Actual Competition ISSN 2277-2456, Volume-II, Issue-IV, Oct-Nov-Dec 2013.
9. International Journal of Movement Education and Social Science, with topic entitled “Comparison of reaction time between morning and evening for Madhya Pradesh state Hockey Academy Girls” IJMESS, March, 2013Vol-2, No.1.
10. International Journal of Movement Education and Social Science, with topic entitled “Physiological Responses of Long Distance runners under actual competition Demands” IJMESS, March, 2013Vol-2, No.1.
11. International Educational E-Journal, Heart Rate Response and Recovery Pattern of Long Distance Runners, {Quarterly}, ISSN 2277-2456, Volume-III, Issue-IV, Oct-Nov-Dec 2014.
12. International Journal of Physical Education and Applied Exercise Sciences (IJPEAES) , with topic entitled “A Study on Blood Glucose Response and Recovery Pattern of Long Distance Runners ” Volume I Number 1 February 2015 ISSN: 2394-9953.
13. International Educational E-Journal, with topic entitled “Lactate Response And Recovery Pattern in long Distance Running- An Overview” {Quarterly}, ISSN 2277-2456, Volume-IV, Issue-III, July-Aug-Sept 2015.
14. Asian Resonance , with topic “Respiratory rate response and recovery pattern of long distance runners”.ISSN 0976 -8602 Volume-IV, Issue-III, July 2015.
15. Dr.Hiralal Yadav (2016) "Physiological Effect of 800mts and 1500mts Distance Running on Heart Rate". Shodh Prerak Vol. VI, Issue 1 Page no 146-149, ISSN: 2231-413X.

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16. Dr.Hiralal Yadav (2016) "Lactate Threshold and Maximum Oxygen Consumption (VO₂MAX)". Vaichariki Vol. VI, Issue I, Page no 78-82, ISSN 2249-8907.
17. Dr.Hiralal Yadav (2016) "Lactate Response and Recovery Pattern in long Distance Running-An Overview" International educational E-Journal, Volume IV Issue III, ISSN: 2277-2456.
18. Dr.Hiralal Yadav (2016) "Respiratory rate response and recovery pattern of long distance runners" Asian Resonance, Volume IV Issue III, ISSN: 0976-8602.
19. Yadav Hiralal , Dec 2016, A comparative study on recovery pattern of 5000mts and 10,000mts distance runners, A Refereed Research Journal Shaikshanik Shodh, Vol.01 Issue: 01
20. Relationship of pace and selected physical variables in middle distance running, International Journal of Yogic, Human Movement and Sports Sciences 2018; 3(2): 152-154
21. Dr. Dalveer Singh Kaunteya, and Dr. HiralalYadav, RELATIONSHIP OF PACE AND HEART RATE IN MIDDLE DISTANCE RUNNING Journal Name:- Sambodhi (UGC care Journal) ISSN:2249-6661 Vol.43 No.04(XI) October-December(2020)
22. Dr. Hiralal Yadav, and Dr. Dalveer Singh Kaunteya, RELATIONSHIP OF PACE AND BLOOD LACTIC ACID AMONG MIDDLE DISTANCE RUNNERS Journal Name:- Sambodhi (UGC care Journal) ISSN:2249-6661 Vol.43 No.04(XI) October-December(2020)

RESEARCH PAPER PUBLISHED IN NATIONAL AND INTERNATIONAL SEMINAR AND CONFERENCE PROCEEDINGS

1.) "Role of information and communication technology in physical Education" in National Seminar on Role of Information and communication technology(ICT) in social Sciences held between 22-24 Feb 2014.
2. "Comparison of maximum oxygen consumption (vo₂ max.) Of 5000m and 10000m distance runners in National Seminar on Impact of Exercise Physiology, Anthropometry and Sports Nutrition on Sports Performance held at Deptt. of Physical Education RDVV Jabalpur between January 03-04, 2014.
3. "A STUDY ON MAXIMUM OXYGEN CONSUMPTION AMONG 5000m and 10000m DISTANCE RUNNERS OF JUNIOR NATIONAL LEVEL in National Conference on Empowering India with Health through Physical Education and Sports organized by Physical Education Foundation of India on 29th August 2014 at Delhi.
4. A study on Investigation of the Recovery Pattern of Long distance runners in relation to Blood Lactate in International Congress on Sports Psychology ICSP-

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2014 at Deptt. of Physical education and sports Science , IGIPSS between 15-18 Oct 2014.

5. A comparative study on selected Physiological variables between Middle and Long Distance Runners belongs to Tigrey Region of Ethiopia in International Congress on Sports Psychology ICSP-2014 at Deptt. of Physical education and sports Science , IGIPSS between 15-18 Oct 2014.
6. Catalytic enzymatic activity of Lactate Dehydrogenase (LDH) among distance runners, National conference of physical education and sports sciences ISBN:978-93-81247-50-1 organized by school of Physical education and sports, ITM University, Gwalior, M.P.
7. Comparison of Sports Competition Anxiety Between Inter-collegiate Volleyball and Badminton Players of HNB Garhwal University in International Congress of Sports Psychology held at Department of Physical Education, Banaras Hindu University, Varanasi, India from 28th November to 1st December 2015.

NATIONAL AND INTERNATIONAL SEMINAR AND CONFERENCE ATTENDED

1. Presented paper on topic “Role of information and communication technology in physical Education” in National Seminar on Role of Information and communication technology (ICT) in social Sciences held between 22-24 Feb 2014.
2. Presented paper on topic “Comparison of maximum oxygen consumption (vo_2 max.) Of 5000m and 10000m distance runners in National Seminar on Impact of Exercise Physiology, Anthropometry and Sports Nutrition on Sports Performance held at Deptt. of Physical Education RDVV Jabalpur between January 03-04, 2014.
3. Presented paper on topic “A STUDY ON MAXIMUM OXYGEN CONSUMPTION AMONG 5000m and 10000m DISTANCE RUNNERS OF JUNIOR NATIONAL LEVEL in National Conference on Empowering India with Health through Physical Education and Sports organized by Physical Education Foundation of India on 29th August 2014 at Delhi.
4. Presented paper on topic “ A study on Investigation of the Recovery Pattern of Long distance runners in relation to Blood Lactate in International Congress on Sports Psychology ICSP-2014 at Deptt. of Physical education and sports Science , IGIPSS between 15-18 Oct 2014.
5. Presented paper as co- author on topic “ A comparative study on selected Physiological variables between Middle and Long Distance Runners belongs to Tigrey Region of Ethiopia in International Congress on Sports Psychology ICSP-2014 at Deptt. of Physical education and sports Science , IGIPSS between 15-18 Oct 2014.

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6. Presented paper on topic Physiological Basis of Yoga and Pranayama in International Seminar on Yoga for the Youth Organized by Department of naturopathy and Yoga, HNBSGU, Srinagar, Garhwal held at Rishikesh on 30th January 2015.
7. Presented paper on topic Comparison of Sports Competition Anxiety Between and Badminton Players of HNB Garhwal University in International Congress of Sports Psychology held at Department of Physical Education, Banaras Hindu University, Varanasi, India from 28th November to 1st December 2015.
8. Presented paper on topic "Choice based credit system (CBCS) An innovative evaluation system of higher education in nation" Seminar on Best Practices in achieving institutional excellence in higher education. On 2nd and 3rd march 2016 organized by Department of Education, HNBSGU Srinagar, Garhwal.
9. Presented paper on topic "Comparison of Sports competition Anxiety between Inter-collegiate Volleyball and Badminton Players of HNB Garhwal University". in International Congress of Sports Psychology held at Department of Physical Education, Banaras Hindu University, Varanasi, India from 28th November to 1st December 2015.
10. Presented paper on topic "Yoga-A Cross Training to enhance athletic performance and reduce the risk of injury" in International conference on Yoga and Holistic Health 12-13 March 2016.
11. Presented paper on topic "Yoga and Holistic Health: An Approach to fitness and wellness , National Seminar on Yoga, Naturopathy & Holistic Health organised by Uttarakhand Open University at Haldwani on 27-28 August 2016.
12. Presented paper on topic "Blood Glucose responses to Long distance running. At International congress on Sports Science and Yoga Between 2-4 Feb 2017.
13. Presented paper on topic "Modern Trends in coaching and Managing Sports Team, International Conference on Issues New Ideas in Sports Management organised by LNIPE Gwalior Held at Vigyan Bhawan, New Delhi on 8th March 2018.
14. Presented paper titled "Role of Yoga in Developing value based education." in International Conference on Developing Human Values Through Yoga organised by Deptt. of Yogic science, Uttarakhand Sanskrit university, Haridwar on 24-25 February 2018.
15. Presented paper with title" RELEVANCE OF YOGA THERAPY IN CONTEMPORARY TIME PERIOD" at 4th Asian Yoga Therapy Conference at Bali, Indonesia from 7th to 8th Sept 2019.

HNB Garhwal University, Srinagar (Garhwal), Uttarakhand

Research and Consultancy Co-ordination Cell

ACTED AS REPERTOIRE /CHAIRPERSON/CO-CHAIRPERSON/RESOURCE PERSON

- Acted as a Co- Chairperson in International Congress on Sports Psychology ICSP-2014 at Deptt. of Physical education and sports Science , IGIPESS between between 15-18 Oct 2014.
- Attended Two days workshop on Relevance of Yoga Therapy in Contemporary period, organized by Department of Yoga, H.N.B.G.University, Srinagar Garhwal, 18-19 May 2019. Participated as a **Resource Person**

SPORTS PROFICIENCY

- ❖ Represented L.N.I.P.E. in All India Inter University Athletics Meets held at Gulbarga University, Gulbarga in the year 2003.
- ❖ Represented L.N.I.P.E. in All India Inter University Athletics Meets held at Ranchi University, Jamshedpur in the year 2004.
- ❖ Represented L.N.I.P.E. in All India Inter University Athletics Meets held at Trenunveli Meet in the year 2006.
- ❖ Participated in All India C.B.S.E. Athletic Meet held at Vijaywada in the year 1999.

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HIRALAL YADAV

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11. Name and address of two experts in area of proposal:-

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HNB Garhwal University, Srinagar (Garhwal), Uttarakhand

Research and Consultancy Co-ordination Cell

Certificate to be produced by the PI at the time of submission of proposal

This is to certify that:

1. **(Dr. Hiralal Yadav)** , the Principal Investigator of the project titled **(Evaluation on Health related Physical Fitness and Nutritional status of School children of Garhwal Uttarakhand)** is working in our University and will assume the full responsibility for implementing the project.
2. The Investigator is a regular employee of our University and working as**Assistant Professor**..... in**Physical Education** department.
3. The date of project starts from the date on which the PI receives the grant from The Research and Consultancy Co-ordination Cell of HNBGU and will be for a period of 2 years.
4. The proposal grant by The Research and Consultancy Co-ordination Cell of HNBGU will be used to meet the expenditure on the project and for the period for which the project has been sanctioned as mentioned in the sanction order.
5. The Department of PI will provide basic infrastructure and other required facilities to the investigator for undertaking the research project.
6. All the consumable and Non -consumable items procured through this grant will be handed over to the Department after the project is completed.
7. PI will bear all the responsibility of executing the project and submitting all the reports in time as when required.

Seal of
University
(HNB Garhwal University, Srinagar Garhwal)

Signature
Registrar

Date:

HNB Garhwal University, Srinagar (Garhwal), Uttarakhand

Research and Consultancy Co-ordination Cell

Certificate from the Principle Investigator

Project

Title:

It is certified that :

1. The same project proposal has not been submitted elsewhere for financial support.
2. I agree to submit a certificate from Institutional Biosafety Committee (IBSC) if the project involves genetically engineered organisms. I also declare that while conducting experiments, the Biosafety Guidelines of Department of Biotechnology, Department of Health Research, GOI would be followed in to.
3. I agree to submit ethical clearance certificate from the concerned ethical committee, if the project involves but not limited to field trails/experiments/exchange of specimens, human & animal materials/Community based studies/Human behavioural Studies etc.
4. The research work proposed in the project does not in any way duplicate the work already done or being carried out elsewhere on the subject.
5. I agree to abide by the terms and conditions of the grant as laid down by the RCC Cell, HNBGU and by the HNB Garhwal University, Srinagar (Garhwal).

Name and signature of Principal Investigator:

Place:

Date:

HNB Garhwal University, Srinagar (Garhwal), Uttarakhand

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