

प्रग संख्या

Serial No. } N^o 001211

संयोजक

Enrolment No. } ६३०६८१९

6-1

हिमाचल प्रदेश विश्वविद्यालय



विद्या-वाचस्पति, 1998

प्रमाणित किया जाता है कि हिमाचल प्रदेश विश्वविद्यालय
में चित्रित सामाजिक समस्याएं
 पर शोध प्रबन्ध स्वीकृत हो जाने के उपरान्त आरती देवी
सुपुत्र/सुपुत्री श्री ओंकार सिंह को इस विश्वविद्यालय की विद्या-वाचस्पति
 की उपाधि प्रदान संकाय में प्रदान की गई।

Himachal Pradesh University

Doctor of Philosophy, 1998

Certified that Arati Devi, son/daughter of
Shri. Onkar Singh after approval of his/her thesis on
"हिमाचल प्रदेश विश्वविद्यालय में चित्रित सामाजिक समस्याएं"
 has been admitted to the degree of Doctor of Philosophy in the
 Faculty of Language in this University.

Arneem

कुलपति

Vice-Chancellor

Kohje

कुलपति

Chancellor

दिनांक

Shimla } 29th June, 1998.



**MALAVIYA MISSION
TEACHER
TRAINING PROGRAMME**



ज्ञान-विज्ञान विमुक्तये
University Grants Commission

Maharshi Dayanand Saraswati University, Ajmer
UGC-MALAVIYA MISSION TEACHER TRAINING CENTRE (MMTTC)
(Erstwhile UGC-Human Resource Development Centre)

CERTIFICATE

This is to certify that

Mr. Virender Singh from Govt. Degree College Khad, Una, Himachal Pradesh has successfully completed the NEP 2020 Orientation & Sensitization Programme under Malaviya Mission Teacher Training Programme (MM-TTP) of University Grants Commission (UGC) organized by UGC-Malaviya Mission Teacher Training Centre, Maharshi Dayanand Saraswati University, Ajmer, Rajasthan from 17th February to 27th February, 2025 and obtained Grade **A**

Prof. (Dr.) Rita Mehra
Director/Coordinator
UGC - MMTTC, MDSUA

MMC-078-2025-FEB-B-03068



सत्यमेव जयते

Government of India



MALAVIYA MISSION
TEACHER
TRAINING PROGRAMME

6.3



उच्च-शिक्षण आयोग

University Grants Commission

CERTIFICATE OF PARTICIPATION

NEP-2020 ORIENTATION & SENSITIZATION PROGRAMME

This is to certify that **Mr. LAKHBIR SINGH**, Assistant Professor of Govt Degree **College Khad**, has completed the NEP 2020 Orientation & Sensitization Programme under Malaviya Mission Teacher Training Programme (MM-TTP) of University Grants Commission (UGC) Organized by UGC-Malaviya Mission Teacher Training Centre, Kumaun University, Nainital (Uttarakhand) from **10/02/2025 – 18/02/2025**.

Singh
Director/Coordinator(MM-TTC)

18/02/25



UNIVERSITY GRANTS COMMISSION
MALAVIYA MISSION TEACHER TRAINING CENTER



6.3

Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhajnagar - 431 004 Maharashtra (India)

NAAC Reaccredited with "A+" Grade

UGC SPONSORED (STC-2024-25-54)
Online STC in MOOC and Online Education
(27/01/2025 to 01/02/2025)

This is to certify that

Dr./Mr./Ms./ Sh Virender Singh, Assistant Professor Political Science Govt
Degree College ,Khad Distt Una, H.P. affiliated to Himachla Pradesh University Shimla
participated in the Online STC in MOOC and Online Education and obtained Grade - B

COURSE COORDINATOR

DIRECTOR



शिक्षा मंत्रालय
MINISTRY OF
EDUCATION



विश्वविद्यालय अनुदान आयोग
University Grants
Commission



6.3

Malaviya Mission Teacher Training Centre SHRI RAM COLLEGE OF COMMERCE University of Delhi

S.no. 48

UID: SRCC/NEP/RC/25-TA/48

Certificate of Completion

This is to certify that Mr. Lakhbir Singh, Assistant Professor from Mohan Lal Dutt Govt. College Khad (HP) has successfully completed the 3rd Refresher Course (Accounting and Taxation) on "Bridging Theory and Practice: Emerging Trends in Accounting and Taxation" organised by the Malaviya Mission Teacher Training Centre, Shri Ram College of Commerce (MMTTC, SRCC) in online mode from February 24, 2025 to March 10, 2025 under the Malaviya Mission Teacher Training Programme (MMTTP) of the Ministry of Education, Government of India.

Overall Grade: A

Dated: April 09, 2025



MALAVIYA MISSION
TEACHER
TRAINING PROGRAMME

Self attested
Dr. Shikha Gupta

Dr. Shikha Gupta
Programme Coordinator
MMTTC, SRCC

Dr. Alok Kumar
Programme Director
MMTTC, SRCC

Prof. Simrit Kaur
Principal
SRCC

Grading Criteria:

A+: 85 % and above | A: 70 % to 84 % | B: 60 % to 69 % | C: 50 % to 59 %



Nuhianwali Education Society

Nuhianwali, Sirsa (Haryana) India

Certificate of Participation

This certificate is presented to

Mr. VIRENDER SINGH

Assistant Professor (Political Science)

Department of Higher Education Govt of Himachal Pradesh

Govt Degree College, Khad, Una

for successfully attending one-week research workshop on

“Synopsis and Thesis Writing”

from 11th November to 17th November 2024 through online mode

organized by **Nuhianwali Education Society.**



(Dr. Kulwant Singh Kookna)
Resource Person

(Vakil Godara)
President
Nuhianwali Education Society



Teaching Learning Centre
Ramanujan College, University of Delhi
(Accredited Grade 'A++' by NAAC)

under the aegis of

MINISTRY OF EDUCATION

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

6.3 (17)



भारत सरकार
Ministry of Education

This is to certify that

Mr. LAKHBIR SINGH

of

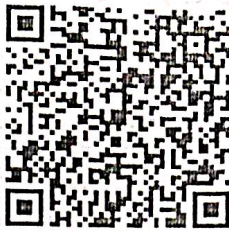
GOVT DEGREE COLLEGE KHAD

has successfully completed online one week Faculty Development Programme on

"Academic Research Writing"

from 01 – 07 January, 2024 and obtained

Grade **A+.**



Blockchain Hash: [0xc458c6d1157066802e875a099f844532201b8eb434381cf0cf6970efd752d8b4](https://www.blockchainhash.com/0xc458c6d1157066802e875a099f844532201b8eb434381cf0cf6970efd752d8b4)

Prof. S. P. Aggarwal

Prof. S. P. Aggarwal
(Principal & Director)
TLC, Ramanujan College

Dr. Sachin Tomer

Dr. Sachin Tomer
(Convenor)
Ramanujan College



Teaching Learning Centre, Ramanujan College
University of Delhi

under the aegis of

MINISTRY OF EDUCATION

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING



मस्यमव जयते
Ministry of Education
Government of India

This is to certify that

Mr. LAKHBIR SINGH

of

GOVT. COLLEGE BANGANA

successfully completed a 4-Week Induction/Orientation Programme for

“Faculty in Universities/Colleges/Institutes of Higher Education”

from 20 April – 19 May, 2022 and obtained

Grade A+.



Blockchain Hash: 0x09b5e7430fe82c00abd459121d96e0f990252e01e5a26090cde716b164f13a75

Prof. S. P. Aggarwal

Prof. S. P. Aggarwal
(Principal & Director)
TLC, Ramanujan College

Dr. Sachin Tomer

Dr. Sachin Tomer
(Convener)
Ramanujan College



6.3 15 (25)



Government of Himachal Pradesh

STATE COUNCIL OF EDUCATIONAL RESEARCH & TRAINING

HIMACHAL PRADESH

SCERT COMPLEX, RABON, SOLAN - 173211

Certificate No. 8324-420

Date: 25.08.2023

*This Certificate is awarded to
Sh./Smt./Km. Mani Ram,
Asst. Prof History,
GDC Khad, District Una
for having attended the
Six days In -Service Induction
Training Programme
for
Assistant Professors*

*Organized at this Institute
w.e.f 21-08-2023 to 26-08-2023*

Shaili Malik
Course Coordinator

Rajendra
Principal



Government of Himachal Pradesh

**STATE COUNCIL OF EDUCATIONAL RESEARCH & TRAINING
HIMACHAL PRADESH**

SCERT COMPLEX, RABON, SOLAN - 173211

Certificate No. 2223-506...

Date: 06/08/2022

This certificate is awarded to

*Sh./Smt./Km. Virender Singh
Assistant Professor, Pol. Science,
GDC Khad, District Una*

on having attended the

Induction Training Programme

Organized at this Institute

w.e.f. 25-07-2022 to 06-08-2022

Rajni
Course Coordinator

R. K. Singh
Principal



सात दिवसीय राष्ट्रीय कार्यशाला

(उत्कृष्ट महाविद्यालय योजना के अन्तर्गत)

गाँव का इतिहास लेखन

कालियुगाब्द 5123, विक्रमी संवत् 2078, फाल्गुन शुक्ल 11-चैत्र कृष्ण 2
(14-20 मार्च, 2022)

आयोजक : इतिहास विभाग व पत्रकारिता एवं जनसंचार विभाग
नेताजी सुभाषचन्द्र बोस स्मारक राजकीय महाविद्यालय हमीरपुर (हि.प्र.)

प्रमाण पत्र

प्रमाणित किया जाता है कि

डॉ० आरती देवी (सहायक आचार्य) हिन्दी विभाग, रा० म० हरीली ने "ग्रामीण इतिहास लेखन में भाषा का महत्व" विषय पर दिनांक 18.03.22 को "संसाधन विशेषज्ञ" के रूप में व्याख्यान दिया। ने नेताजी सुभाष चन्द्र बोस स्मारक राजकीय महाविद्यालय हमीरपुर में

आयोजित 'सात दिवसीय राष्ट्रीय कार्यशाला' में भाग लिया।

प्रो. सीरम सूद
आयोजन समिति

डॉ० रमेश कुमार शर्मा
संयोजक

डॉ० अजय बतुता सहगल
प्राचार्य व संरक्षक



Sr. No.: E-234

Two-Day
International Conference
on

**"EXPLORING THE LITERARY SPACE AS A BRIDGE ACROSS
DISCIPLINES"**

15th & 16th November 2024

Organized by
Department of English

Government College Una(H.P)
'Institution of Excellence'

Certificate of Paper Presentation



This Certificate is presented to Prof./Dr./Mr./Ms.

.....*LAKHBIR Singh*.....of
.....*G. D. C. Khad*.....in

recognition of active participation and presentation of paper titled
Effect of Digitalization on Indian
Economy.....in the conference.

Anita Kumari
Conference Convenor
Prof. Anita Kumari

Amarjeet Mann
Organizing Secretary
Prof. Amarjeet Mann

Meeta Sharma
Conference Patron
Dr. Meeta Sharma



Sr. No.: E-216

Two-Day
International Conference
on

**"EXPLORING THE LITERARY SPACE AS A BRIDGE ACROSS
DISCIPLINES"**

15th & 16th November 2024

Organized by
Department of English

Government College Una(H.P)
'Institution of Excellence'

Certificate of Paper Presentation

This Certificate is presented to Prof./Dr./Mr./Ms.

Dr. Arti Devi

Government college Khad.

in recognition of active participation and presentation of paper titled

Sahitya me lokgeet or loktatav

in the conference.

Conference Convenor
Prof. Anita Kumari

Organizing Secretary
Prof. Amarjeet Mann

Conference Patron
Dr. Meeta Sharma

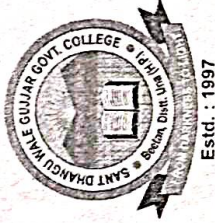
Regd. No. : 004

INTERNATIONAL CONFERENCE

On

“Exploring Climatic Sustainability: Opportunities and Challenges”

July 26-27, 2024



Organised by

S.D.W.G. Govt. College Beetan, Una (H.P.)

CERTIFICATE

This is to certify that Professor / Asstt. Professor / Associate Professor / Research Scholar

Mr. Rakesh Sharma

of Government Degree College, Khad, actively participated and presented paper entitled
Climatic Sustainability & SDGs of India
in the International Conference.

Dr. Daleep Bali
Convener

Prof. Gurdev Singh
Co-ordinator

Dr. Sunita Goyal
Principal
S.D.W.G. Govt. College Beetan

Regd. No. : 051

INTERNATIONAL CONFERENCE

On

“Exploring Climatic Sustainability: Opportunities and Challenges”

July 26-27, 2024



Estd. : 1997

Organised by

S.D.W.G. Govt. College Beetan, Una (H.P.)

CERTIFICATE

This is to certify that Professor / Asstt. Professor / Associate Professor / Research Scholar

Mr. Lakhbir Singh

of Govt Degree College Khad, actively participated and presented paper entitled
Green Finance: Encouraging Sustainable Development in India
in the International Conference.

Dr. Daleep Bali
Convener

Prof. Gurdev Singh
Co-ordinator

Dr. Sunita Goyal
Principal
S.D.W.G. Govt. College Beetan

Seal of S.D.W.G. Govt. College Beetan



ठाकुर रामसिंह इतिहास शोध संस्थान

नेरी, हमीरपुर (हि.प्र.)

द्वारा आयोजित

त्रिविधसीया वकार्यशाला

हिमाचल प्रदेश का बृहत् इतिहास

कलियुगाब्द 5125, विक्रमी संवत् 2080, फाल्गुन प्रविष्टे 4-6
(16-18 फरवरी, 2024)

प्रमाण पत्र

प्रमाणित किया जाता है कि प्रो. /डॉ. /श्री/श्रीमती/सुश्री ने हिमाचल प्रदेश का बृहत् इतिहास विषय पर आयोजित कार्यशाला में संदर्भ प्रवक्ता/विषय विशेषज्ञ/वक्ता के रूप में भाग लेने का अवसर प्राप्त किया।

श्रीधर पर अपना व्याख्यान दिया/सहभागिता की।

क्रमांक
दिनांक 18/02/24

प्रो. नारायण सिंह
कार्यशाला संयोजक एवं
परिचालन निदेशक

डॉ. नारायण सिंह
अध्यक्ष, शोध संस्थान

6.55 (50)

91



समृद्धि विद्यते विभिन्नम्

6.5 (8)



ठाकुर रामसिंह इतिहास शोध संस्थान नेरी, हमीरपुर (हि.प्र.)

एवं

भारतीय इतिहास अनुसंधान परिषद् (ICHR) नई दिल्ली

द्वारा आयोजित

राष्ट्रीय परिसंवाद हिमाचल प्रदेश की सांस्कृतिक धरोहर

कलियुगाब्द 5126, विक्रमी संवत् 2081, वैशाख कृष्ण 11-12 (04-05 मई, 2024)

प्रमोणी पत्र

प्रमाणित किया जाता है कि..... डॉ. आरती देवी..... लक्ष्मण कान्हा हिन्दी रा.प्र. रविवर जिला फना
ने राष्ट्रीय परिसंवाद में भाग लिया। प्रतिभाषी ने..... जिला फना नी सांस्कृतिक धरोहर - आदि - न छन्द मं
.....विषय पर अपना शोध पत्र प्रस्तुत किया/सहभागिता/तकनीकी सत्र की अध्यक्षता/उपाध्यक्षता की।

क्रमांक 139.....
दिनांक 05/05/24..

आयोग/सचिव
राष्ट्रीय परिसंवाद

राष्ट्रीय परिसंवाद

राष्ट्रीय परिसंवाद
इतिहास शोध संस्थान नेरी



विवश्व दशन ढवस

के उपलक्ष्य पर

इतिहास विभाग

सरदार पटेल विश्वविद्यालय मण्डी (हि.प्र.)

द्वारा आयोजित

भारतीय दार्शनिक अनुसंधान परिषद्, नई दिल्ली

(शिक्षा मंत्रालय, भारत सरकार)

द्वारा वित्तपोषित

राष्ट्रीय संगोष्ठी

भारतीय संस्कृति में निहित मौलिक मूल्य तथा राष्ट्रीय पुनर्निर्माण में उनकी प्रासंगिकता

कलियुगाब्द 5125, विक्रमी संवत् 2080, मार्गशीर्ष अमावस्या (12 दिसम्बर, 2023)

प्रमाण-पत्र

प्रमाणित किया जाता है कि प्रो०/डॉ०/श्री/श्रीमती/सुश्री आरती देवी लक्ष्मण शर्मा हि-प्र
..... बा.वि.संस्कृति मण्डल दिल्ली हि-प्र
ने भारतीय संस्कृति में निहित मौलिक मूल्य तथा राष्ट्रीय पुनर्निर्माण में उनकी प्रासंगिकता विषय पर आयोजित राष्ट्रीय संगोष्ठी में बीज वक्ता/ विषय विशेषज्ञ /
सत्राध्यक्ष/ सह-सत्राध्यक्ष के रूप में योगदान दिया। संगोष्ठी में आरती देवी लक्ष्मण शर्मा (आरती देवी)

श्रीर्षक पर शोध पत्र प्रस्तुत किया / सहभागिता की।

क्रमांक : 40-05

दिनांक : 12/12/23

श्री अरती देवी लक्ष्मण शर्मा
आयोजन सचिव

सरदार पटेल विश्वविद्यालय, मण्डी (हि.प्र.)

डॉ. आरती देवी लक्ष्मण शर्मा
संयोजक, राष्ट्रीय संगोष्ठी

सरदार पटेल विश्वविद्यालय, मण्डी (हि.प्र.)

अतिथि (डॉ.) अनुपमा सिंह
प्रति कुलपति एवं अधिकाता अकादमिक मानने
सरदार पटेल विश्वविद्यालय, मण्डी (हि.प्र.)



सरदार पटेल विश्वविद्यालय मण्डी (हि.प्र.)

इतिहास विभाग

व

ठाकुर रामसिंह इतिहास शोध संस्थान नेरी, हमीरपुर (हि.प्र.)

के संयुक्त तत्वावधान में आयोजित

एवं

भारतीय इतिहास अनुसंधान परिषद, नई दिल्ली

(शिक्षा मंत्रालय, भारत सरकार)

द्वारा वित्तपोषित

राष्ट्रीय संगोष्ठी

विषय: स्वराज संघर्ष व राष्ट्र एकीकरण में सरदार वल्लभभाई पटेल का योगदान
Contribution of Sardar Vallabhbhai Patel in Swaraj Struggle and Nation Integration
कलियुगाब्द 5125, विक्रमी संवत् 2080, कार्तिक कृष्ण 02-03 (30-31 अक्टुबर, 2023)

प्रमाण-पत्र

प्रमाणित किया जाता है कि प्रो./डॉ./श्री/श्रीमती/सुश्री आरती देवी

सहायक आचार्य, हिंदी विभाग, राष्ट्रीय महाविद्यालय, बड़ौदा, गुजरात

ने स्वराज संघर्ष व राष्ट्र एकीकरण में सरदार वल्लभभाई पटेल का योगदान विषय पर आयोजित राष्ट्रीय संगोष्ठी में सरदार पटेल की आर्थिक नीतियां और राष्ट्रीय स्वतंत्रता पर उनका प्रभाव

शीर्षक पर शोध पत्र प्रस्तुत किया / सहभागिता की।

आपके यशस्वी जीवन की कामना करते हुए यह प्रमाण पत्र आपको सहर्ष प्रदान किया जाता है।

क्रमांक : HIS-37

दिनांक : 31/10/2023

आयोजन सचिव
राष्ट्रीय संगोष्ठी

संयोजक
राष्ट्रीय संगोष्ठी

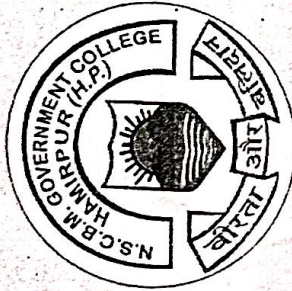
प्रति कुलपति
अधिष्ठाता, अकादमिक मामले
सरदार पटेल विश्वविद्यालय मण्डी (हि.प्र.)

6.5.3 (79)

2nd International Conference on Mathematics in Space and Applied Sciences

(ICMSAS-2023)

March 03-04, 2023



Organised By

Department of Mathematics

NSCBM Govt. College, Hamirpur, Himachal Pradesh, INDIA

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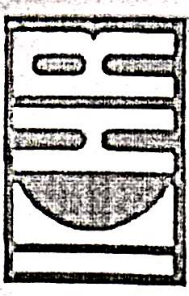

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आजादी
अमृत महोत्सव



इतिहास विभाग
हिमाचल प्रदेश केंद्रीय विश्वविद्यालय, धर्मशाला
द्वारा आयोजित
दो दिवसीय राष्ट्रीय संगोष्ठी, अगस्त 22-23, 2022
भारत में 'स्व' जागरण (हिमाचल प्रदेश के विशेष संदर्भ में)

प्रमाण - पत्र

प्रमाणित किया जाता है कि ...
ने आयोजित संगोष्ठी में विषय विशेषज्ञ/सत्र अध्यक्ष/शोधपत्री/शोध पत्र प्रस्तुतकर्ता के रूप में भाग लिया है।
शोध पत्र का शीर्षक.....

Rajeev Kumar
डॉ. राजीव कुमार
आयोजन सचिव

Date: 23.08.2022

Dr. Rajendra Yadav
डॉ. राघवेंद्र यादव
संयोजक

प्रमाण - पत्र क्रमांक :



NATIONAL SEMINAR

ON



75
आजादी का
अमृत महोत्सव

Revisiting the Role of Netaji Subhash Chandra Bose to the Freedom Struggle of India

Kali. 5124, Vikarmi Samvat 2079, Shrawan Shukal 11-12 (8-9 August, 2022)

Organized by

Department of History, NSCBM Govt. College Hamirpur (H.P.)

&

Thakur Ramsingh Itihas Shodh Sansthan Neri, Hamirpur (H.P.)

Sponsored by

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Arti Devi Dept. of Hindi

of G.C. Haroli Dist Una (H.P.) has Participated/Presented

paper Role of Netaji Subhash Chandra Bose in the Freedom Struggle of India in the two days National Seminar

organized by Department of History, NSCBM Govt. College Hamirpur (H.P.) & Thakur Ramsingh Itihas Shodh Sansthan Neri, Hamirpur (H.P.)

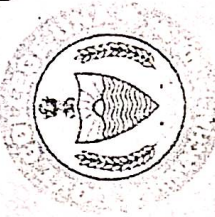
He/She has Chaired/Co-chaired the session.

Sr. No. : 105

Date : 09/08/22

Organizing Secretary

Principal



1ST INTERNATIONAL CONFERENCE ON ENGLISH LANGUAGE, LITERATURE AND CULTURE

10th & 11th December 2022

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CRN- 2039

This is to certify that *Dr. Priti Desai*, Assistant Professor of Govt. College Haroli, Distt. Una (HP) chaired/ co-chaired a technical session during the International Conference organized by The Achievers Foundation for English Studies (TAFES), MALAVIYA Gorakhpur (UP) & Govt. College Una (HP).

Dr. Raman Kumar

Dr. Raman Kumar
Conference Secretary

Dr. S. N. Singh

Dr. S. N. Singh
Conference Convener

Prof. (Dr.) Sanjay P. Pandey

Prof. (Dr.) Sanjay P. Pandey
Conference Chairman

6.500

81

6.5 (6)

INTERNATIONAL CONFERENCE

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82

ON

CHANGING TRENDS IN DIASPORIC LITERATURE

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and presentation of paper entitled Strategic Significance of Digital Library

In the Conference,

27

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Dr. Meeta Sharma

Dr. Kamal Kumar
Organizing Secretary

Prof. Satdev Bhardwaj
Conference Patron



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from

Lalbir Singh

Sant Baba Bhag Singh University participated in the event. He/she presented Research Paper entitled Investor's Awareness of different investment in the "International Conference on Research and Innovation in Multidisciplinary Studies (ICRIMS-2022)" organized by Sant Baba Bhag Singh University in association with ICT Academy, Punjab Pollution Control Board and Punjab State Council for Science & Technology under the aegis of IQAC and MoE Innovation Cell held from

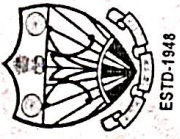
30th May to 1st June 2022.

Registrar

Vice-Chancellor

Chancellor

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वल्लभ राजकीय महाविद्यालय, मण्डी (हि.प्र.)
हिमाचल कला संस्कृति भाषा अकादमी, शिमला
एवं

इतिहास शोध संस्थान नैरी, जिला हमीरपुर (हि.प्र.)

के संयुक्त तत्वाधान में आयोजित

राष्ट्रीय संगोष्ठी

विषय : मण्डी जनपद का इतिहास एवं संस्कृति
कलियुगाब्द 5123, विक्रमी संवत् 2078, फाल्गुन 4 प्रविष्टे तदनुसार 15 फरवरी, 2022

प्रमाण पत्र

प्रमाणित किया जाता है कि डॉ. अमली देवी राजकीय कान्चनपुरी जिला राजकीय महाविद्यालय हरदोली (कन्या) ने संगोष्ठी में भाग लिया। प्रतिभाषी ने मण्डी इतिहास संगोष्ठी में अपनी रचनाओं का योगदान
.....

विषय पर शोध पत्र प्रस्तुत किया/बीस-वक्तव्य दिया/आयोजन किया/तकनीकी सत्र की अध्यक्षता की।

प्राचार्य
वल्लभ राजकीय महाविद्यालय

निदेशक

महिला



RESEARCH ARTICLE

Application of Mathematics in Economic Theory

Rakesh Sharma

Assistant Professor of Economics, Govt. Degree College, Khad, District Una, H.P. – 177207

*Corresponding Author E-mail: jagjitsinghpatial@gmail.com

Abstract:

Application of Mathematics into Economic Theory is a formal description of certain relationships of economic variables; some of these relationships are derived from empirical observations while other ones are deduced from theoretical axioms based on a Rational Economic Agent. Mathematization of Economic Theory broadly started in the second quarter of the 20th Century due to shift of emphasis from partial to general equilibrium analysis, economic dynamism, growth theories and technical progress. In present scenario, it is being widely accepted as a tool in improving Economic Theory and corrective measures for the formulation of Economic Policy; Fiscal and Monetary Policies.

Economic reasoning based on mathematics, in the form of a set of equations and simplified mathematical relationships has been a fundamental factor in the development of Economic Theory as a Science approximating to reality sufficiently closed. Having a fair idea of economic problems with expert knowledge supplemented by appropriate mathematical techniques do provide a better formal insight into the problem and promotes understanding in a systematic and consistent form. Empirical support and mathematical logic makes the theory easily understandable and to form meaningful and testable propositions. That is why Mathematical Methods are being recognized as a rational approach in solving Economic Problems; rational decision making, understanding cause and effect relationship between economic variables, utility and profit maximization, optimum allocation of resources, least cost-combination subject to budget constraint, factor price determination, distribution aspect of the Gross National Product (GNP) and growth path of the economy.

Mathematical Equations in Economic Theory:

While applying Mathematics into Economic Theory, equations can be distinguished in to three parts;

1. Definitional Equations e.g. Profit Maximization behaviour of a Firm or a Producer
Profit (π) = Total Revenue (TR) – Total Cost (TC)
2. Behavioural Equations e.g. Consumption Behaviour in an Economy $C = 40 + 0.75 Y$
3. Equilibrium Equations e.g. determination of Market Equilibrium with Demand and Supply Functions
Demand Function $Q_d = a - b P$
Supply Functions $Q_s = c + g P$

Differential Equations provide solution to Demand and Supply functions resulting in Equilibrium Price. First Order Difference Equations provide solution to Dynamics of the Equilibrium i.e. how fluctuations converge or diverge to Equilibrium and paves the way for understanding a Business Cycle over a period of time.

Prof. Cournot, mathematically developed equilibrium market condition in view of competition between two sellers referred as **Cournot Duopoly**. Differentiating the profit function with respect to quantity supplied for each firm, **Cournot** deduced a system of linear equations, the simultaneous solution of which gave the equilibrium price, quantity and profit under Duopoly.

Application of Mathematics in Optimization Theory:

In the simplest form, an optimization problem involves maximizing or minimizing a function, satisfying general necessary and sufficient conditions for optimality. As the main objective of a Consumer is to maximize his Utility from the goods subject to his purchasing power i.e. Budget Constraint. Thus, Utility Optimization is attained by using **Lagrange Multiplier and Bordered Hessian Determinant**

To maximize the Utility Function $U(x_1, x_2)$ subject to the budget constraint $y = p_1x_1 + p_2x_2$

$$Z = U(x_1, x_2) - \lambda(p_1x_1 + p_2x_2 - y)$$

$$\partial Z / \partial x_1 = u_1 - \lambda p_1 = 0$$

$$\partial Z / \partial x_2 = u_2 - \lambda p_2 = 0, \text{ Now it follows that } \lambda = \frac{u_1}{p_1} = \frac{u_2}{p_2}$$

Thus Marginal Utilities should be proportional to prices for consumer equilibrium and hence for maximum utility. With the help of Partial Derivates, Slutsky divided Price Effect into Income effect and Substitution effect of various goods. Generalized form of Slutsky Equation is:-

$$\partial q_i / \partial p_i = (\partial q_i / \partial p_i)_U - \text{constant} \quad \text{and} \quad q_i (\partial q_i / \partial y)_P - \text{constant}$$

Commodity q_i is defined as Normal good if $\partial q_i / \partial p_i < 0$, Giffen good if $\partial q_i / \partial p_i > 0$ and Inferior good if $\partial q_i / \partial y < 0$

Given the Demand Function: $Q = a - bP$, where P is Price and Q is quantity demanded, then Consumer's Surplus is expressed as $\int_0^Q f(q) dq - P \cdot Q$

Given the Supply Function: $Q = c + gP$, where P is Price and Q is quantity demanded, then Producer's Surplus is expressed as $P \cdot Q - \int_0^Q f(q) dq$

As the main objective of an Entrepreneur is to maximize his Profits.

$$\text{Profit } (\pi) = \text{Total Revenue (TR)} - \text{Total Cost (TC)}$$

In order to Maximize Profits, First order condition is: $d\pi/dQ = 0$

$$\text{and Second order condition is: } d^2\pi/dQ^2 < 0$$

For Profit Maximization subject to Budget Constraint, **Lagrange Multiplier** ($\partial Z / \partial x_n = 0$) and **Bordered Hessian determinant** ($\partial^2 Z$ is negative, H_1 is +ve) is applied.

Other objective of an Entrepreneur is to minimize his cost of production.

In order to Minimize Cost, First order condition is $d\pi/dQ = 0$

$$\text{and Second order condition is } d^2\pi/dQ^2 > 0$$

For Cost Minimization subject to Budget Constraint, **Lagrange Multiplier** ($\partial Z / \partial x_n = 0$) and **Bordered Hessian determinant** ($\partial^2 Z$ is positive, H_1 is -ve) is applied.

Application of Mathematics in Production and Distribution:

Production itself can be described as a conversion of Inputs into output.

C.W. Cobb and P.H. Douglas introduced a general production Function: $Q = A K^\alpha L^\beta$

Q is total output, K is the Capital input and L is the Labour input. A is efficiency parameter, α and β are output elasticities. The main feature of this function is that it is homogeneous of degree one ($\alpha + \beta = 1$), depicting constant returns to scale of Production.

Kenneth Arrow, Hollis Chenery, Bagicha Minhas and Robert Solow introduced another Production Function which is linearly homogeneous and having the constant elasticity of Substitution named as **C.E.S. Production Function**.

$$Q = A[\alpha K^{-\beta} + (1-\alpha)L^{-\beta}]^{-1/\beta}$$

This function being linearly homogeneous, depicts constant returns to scale and qualifies for the application of **Adding-up Theorem/ Euler's Theorem**, describing that if each factor is paid according to its marginal product, then the total product will just get exhaust, thereby providing a solution to the distribution of National Product in the Economy.

In Production, Least-Cost combination is attained when ratio of Marginal Productivity of factors of production equates to ratio of factor prices: $MP_L / MP_K = w / r$

Application of Mathematics in Growth Theory and Fluctuations:

Capital Formation is a necessary condition for Economic Growth and Development. Capital Formation is a the process of adding to a given stock of capital (dk/dt) or the rate of net investment flow $I(t)$ over the period of time t .

Therefore, $dk/dt = I(t)$ or $k(t) = \int \frac{dk}{dt} dt = \int I(t) dt$

Income from Investment $Y = \sum_{t=0}^n a^t / (1+r)^t$

Present Value (a^t) of any Investment depends upon the rate of interest (r) and its frequency of being added up in n years.

Growth Path of **Herrod-Domar and Solow Model** describes that capital grows at a rate of $g = s/v$ where s is the propensity to save and v is the capital-output ratio).

Further, Differential Equations Model of **Dynamic Multiplier** deduces that Investment has a multiplier effect on the level of Income, output and employment in an economy.

Herrod and Domar propounded their Multiplier-Accelerator Theory describing that for full employment equilibrium, rate of growth of Labour force termed as natural rate of growth should be equal to the relative value of saving and capital-output ratio ($n = s/v$)

By using Second Order Difference Equations, **Paul Samuelson** developed his Multiplier-Accelerator Interaction Theory describing that different combination of s (propensity to save) and β (accelerator) will generate different time-paths of national Income leading to convergent/explosive non-cyclic/explosive cyclic/damped or regular growth path over the period of time.

The Cobweb Theory on the basis of Static Demand Function ($X_{Dt} = a - \alpha P_t$) and Lagged Supply Function ($X_{St} = -b + \beta P_{t-1}$), by using Difference equations, described that growth path over time tend to be oscillatory in terms of explosive oscillations, damped oscillations or regular oscillations.

Application of Mathematics in Input-Output Analysis:

Russian born Economist **Wassily W. Leontief** developed Input-Output Analysis by using Technology Coefficient Matrix thereby providing a solution to the problem that what level of output of each producing sector in an economy can bring about equilibrium for its product in the economy as a whole. **Hawkins and Simon**, further deduced viability of the General Solution for Input-Output Analysis.

Application of Mathematics in Game Theory:

Game theory propounded by **John Von Newmann** introduces the possibility of more than one decision-maker, wherein optimum value of the Objective function for any one decision maker depends not only on his choice but also on the choice of the others. Some players may be risk averters while the others may be risk lovers. Value of the game is just the outcome when both/all the players follow their best strategy thereby reaching to a **Saddle Point Solution** in a Pure Strategy. However, in a mixed strategy, solution of the game is attained by Dominance Probability Method, or Linear Programming Method. Almost every Economic Game Theory serves to support an economic policy.

Application of Mathematics in Linear Programming:

Linear Programming is applied to determine optimal allocation to meet out the given objectives may be to maximize or minimize it subject to a number of constraints in the form of linear inequalities.

The original problem is referred as a Primal Problem. If the Primal Problem requires maximization, the Dual problem is one of minimization. However, value of Dual Objective function will always be greater than or equal to the value of the Primal Objective function termed as **Kuhn Tucker Theorem**. To find out optimal solution of the objective function, we move from one basic feasible solution to another basic feasible solution until the Optimal Solution is achieved. Extensions to Non-linear Optimization with inequality constraints were developed by **Albert W. Tucker and Harold Kuhn** in 1951.

It may be concluded that in order to explain the rules of economic theory, mathematical methods based on economic reasoning have been widely used in providing solution to a number of economic problems as it is reflected from the work of many economists, thereby this way it proves that, in practice, mathematics is not a substitute but a complement for the economic sciences, offering new sources for theories, postulates, axioms, theorizations, and explanations. As test of a Theory lies in its empirical verification, therefore, new Economic Theories, new concepts and axioms in Economics, passed through the filter of mathematical logic with empirical support are easily

understandable and to form meaningful and testable propositions thereby providing a high level of credibility and its impact in the Economy. Economics and Mathematics obtaining this way, has propelled both Mathematics and Economics amongst the noble sciences.

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Ref. No: HPU©/2024/-

Dated: 05.12.2024

TO WHOM IT MAY CONCERN

This is to certify that Dr. Rajindra Sharma, Principal, Govt. College Khad (District Una) has attended the meeting of Board of Studies (UG) Commerce as one of the members of the Board of Studies (UG) Commerce on dated 04.12.2024 and 05.12.2024 in the Department of Commerce, Himachal Pradesh University, Shimla vide No. HPU(C)/BOS/(PG/UG)/14/- dated 28.11.2024. He has relieved on 05.12.2024 at 5.00 P.M.

D. Sharma
CHAIRMAN 5-12-24

Dept. of Commerce
H.P. University, Shimla - 5

Regd. No. : P-IV

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On

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July 26-27, 2024



Organised by

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CERTIFICATE

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Mr. Ravi Raj

of Govt. Degree College Khad, Chaired the Technical Sessions
in the International Conference.


Dr. Daleep Bali
Convener


Prof. Gurdev Singh
Co-ordinator

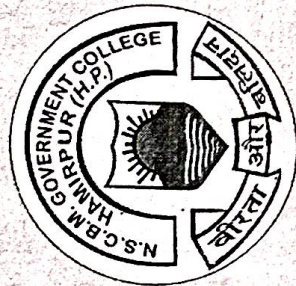

Dr. Sunita Goyal
Principal
S.D.W.G. Govt. College Beetan

6.10.23 (104)

2nd International Conference on Mathematics in Space and Applied Sciences

(ICMSAS-2023)

March 03-04, 2023



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NSCBM Govt. College, Hamirpur, Himachal Pradesh, INDIA

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This is to certify that Prof./Dr.7 Mr./Ms. Rakesh Sharma of Govt. Degree College, Khad, District Una, H.P. – 177207 has actively participated in the 2nd International Conference on Mathematics in Space and Applied Sciences (ICMSAS-2023) organized by the Department of Mathematics, Netaji Subhash Chander Bose Memorial Govt. College, Hamirpur-177005, Himachal Pradesh, INDIA on March 03-04, 2023 and Chaired a session.


Dr. Sanjay Kango
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for being the Session[✓] Chair/ Co-Chair in the
conference.

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Prof. Anita Kumari

Amarjeet Mann
Organizing Secretary
Prof. Amarjeet Mann

Meeta Sharma
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