MAHILARATNA PUSHPATAI HIRAY ARTS, SCIENCE & COMMERCE MAHILA MAHAVIDYALAYA, MALEGAON CAMP, NASHIK

3rd Cycle

Assessment & Accreditation

Criterion – 3

Research, Innovation and Extension

Key Indicator- 3.5 Collaboration

QnM – 3.5.1   The number of MoUs, collaborations/linkages for Faculty exchange, Student exchange, Internship, Field project, On-the- job training, research and other academic activities during the last five years

List of Collaboration (2017 to 2022)

1) Faculty Exchange

List of Faculty Exchange and Documents

SN	Name of the partnering institution/ industry/ research lab	Faculty	Activity	Year
1	Kakani School Malegaon Nashik	Dr. R. B. Sawant	Chief Guest at inaugural Programme	2022
2	Tata Institute of Social Science Osmanabad	Dr. P. A. Survase	Delivered Guest Lecture	2022
3	Arts Commerce and Science College Ravalgaon Malegaon Nashik	Dr. Y.S. Patil	Delivered Guest Lecture	2022
4	KTHM College Nashik-02	Dr. Deepanjali Borse	Delivered Guest Lecture	2021
5	Tata Institute of Social Sciences Osmanabad	Dr. P. A. Survase	Delivered Guest Lecture	2021
6	Arts & Science College Mhasdi Dist. Dhule	Dr. Deepanjali Borse	Guest Lecture delivered in Workshop	2020

1) Dr. R. B. Sawant
Kakani School Malegaon Nashik

मालेगांव एज्युकेशन सोसायटी संचलित,
☎ : 02554 - 232808

सौ. रुक्मीणीबाई झुंबरलाल काकाणी कन्या विद्यालय

भुईकोट किल्ला, मालेगांव – ४२३ २०३ (नासिक)

● School Index No.S. 13.16.001   ● School Code No.MLN - 9   ● e-mail. srzkvidyalay@gmail.com

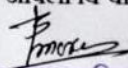जावक क्र.   दिनांक : ३० जुलै २०२२

प्रति,

मा.डॉ.प्रा.राजश्री भीमराज सावंत ,

एस.पी.एच.महिला महाविद्यालय,मालेगांव

विषय :- विज्ञान छंद मंडळ उद्घाटन.................

महोदय,

वरील विषयान्वये आमच्या सौ. रू. झुं. काकाणी कन्या विद्यालयात विद्यार्थिनींच्या सर्वांगीण विकासासाठी विज्ञान छंद मंडळाची स्थापना होत आहे. या मंडळाचे उद्घाटन आपल्या शुभहस्ते व्हावे अशी आमची इच्छा आहे. तरी आपण आमच्या विद्यालयात दि.०१ ऑगस्ट २०२२ सोमवार रोजी येऊन विज्ञान छंद मंडळाचे उद्घाटन करून मार्गदर्शन करावे ही नम्र विनंती.

आपली विश्वासू

मुख्याध्यापिका
सौ. रु. झुं. काकाणी कन्याविद्यालय
जिल्हा, मालेगांव (नासिक)

विज्ञान छंद मंडळाची स्थापना

मालेगाव (का. प्र.) : येथील सौ. रु. झु. काकाणी कन्या विद्यालयात विज्ञान छंद मंडळ स्थापन करण्यात आले. मुख्याध्यापिका शोभा मोरे कार्यक्रमाच्या अध्यक्षस्थानी होत्या. प्रमुख पाहुणे म्हणून महिला महाविद्यालयाच्या प्रा. डॉ. राजश्री सावंत होत्या. प्रमुख पाहुण्यांच्या हस्ते सरस्वती, भारतमाता, लोकमान्य टिळक, शाहीर अण्णा भाऊ साठे यांच्य प्रतिमांचे पूजन करण्यात आले. प्रा. डॉ. सावंत यांनी विज्ञान छंद मंडळ स्थापनेचा उद्देश, अंधश्रद्धा निर्मूलन, विज्ञान शिक्षकांची जबाबदारी, नॅनो तंत्रज्ञानाचा अर्थ, त्याचे फायदे, वापर, विविध वस्तूंची उदाहरणे, तसेच विज्ञानाला अध्यात्माची जोड असली पाहिजे व विद्यार्थिनींनी विज्ञान जगायला शिकले पाहिजे, असा मोलाचा सल्ला दिला. सुधीर पाटील यांन प्रास्ताविक केले. परिचय वैशाली महाजन यांनी करून दिला. मनीषा अहि यांनी आभार मानले. कार्यक्रमास पर्यवेक्षक राजेश परदेशी यांच्यासह विज्ञानशिक्षक, शिक्षकेतर कर्मचारी उपस्थित होते.

2. Dr. P. A. Survase
Tata Institute of Social Sciences Osmanabad

टाटा सामाजिक विज्ञान संस्थान
Tata Institute of Social Sciences
(Tuljapur Campus)

RE-IMAGINING FUTURES
T I S S

To

Dr. Pradnya A. Survase

Assistant Professor

Department of Mathematics,

Mahilaratna Pushpatai Hiray Arts, Sciences and

Commerce Mahila Mahavidyalaya,

Malegaon, Dist: Nashik-423 105.

Date: February 15, 2021

Subject: Invitation for Guest Lecture --- Reg.

Dear Madam,

Greetings!

This gives us immense pleasure to invite you to deliver a guest lecture on **"Role of Mathematics in Social Sciences"** on February 21, 2022 at **Tata Institute of Social Sciences Tuljapur Campus Tuljapur Dist: Osmanabad.** Surly this lecture will benefit to our students to get in-depth knowledge of the subject.

Thanks once again.

Thanking you,

Gunvant A Birajdar

BASS- Coordinator

Tata Institute of Social Sciences

Tuljapur, Dist: Osmanabad-413601.

डाक पेटी क्रमांक 9
अपसिंगा रोड, ता. तुलजापूर 413 601
जिला – उस्मानाबाद
Post Box No 9
Apsinga Road, Tal. Tuljapur 413 601
Dist. Osmanabad

दूरभाष Telephone : 09270105222 / 23 / 24 / 25 /26
फॅक्स Fax : 02471 - 242061
वेबसाइट Website : www.tiss.edu
ई मेल Email : info.srd@tiss.edu

A Deemed University established under
Section 3 of the UGC Act. 1956, vide
Notification No. F11-22/62-U2, dated
29th April, 1964, of the Government of
India, Ministry of Education

टाटा सामाजिक विज्ञान संस्थान
Tata Institute of Social Sciences
(Tuljapur Campus)

RE-IMAGINING FUTURES
T I S S

To

Dr. Pradnya A Survase

Assistant Professor

Department of Mathematics,

Mahilaratna Pushapatai Hiray Arts, Sciences and

Commerce Mahila Mahavidyalaya

Malegaon, Dist: Nashik-423 105.

Date: February 16, 2021
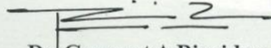
Subject: Appreciation letter---Reg

Dear Mam,

Greetings!

We are very much thankful for such a wonderful, informative, and in-depth lecture on the **"Role of Mathematics in Social Sciences"** at Tata Institute of Social Sciences Tuljapur, Dist: Osmanabad.

We are looking forward to your further intervention on the same.

Thanks

Yours faithfully.

Dr. Gunvant A Birajdar

BASS -Coordinator

Tata Institute of Social Sciences Tuljapur.

डाक पेटी क्रमांक 9
अपसिंगा रोड, ता. तुळजापूर 413601
जिला – उस्मानाबाद
Post Box No 9
Apsinga Road, Tal. Tuljapur 413601
Dist. Osmanabad

दूरभाष Telephone: 09270105222 / 23 / 24 / 25 / 26
वेबसाइट Website: www.tiss.edu

A Deemed University established under Section 3 of the UGC Act, 1956, vide Notification No. F11-22/62-U2, dated 29th April, 1964, of the Government of India, Ministry of Education

3. Dr. Y.S. Patil
Arts Commerce & Science College Ravalgaon ,Malegaon- Nashik

Shree Swami Samarth Vidya Prasarak Mandal
Dangsaundane, Tal. : Baglan, Dist. Nashik Sanchalit

ARTS, COMMERCE & SCIENCE COLLEGE,
Ravalgaon, Tal. Malegaon, Dist. Nashik-423108

ID No.: PU/NS/A-140/2009 ☏ 8275115556 ✉ acscollegeravalgaon@gmail.com ✉ sssvpm2013@gmail.com

■ Grand No.: NGC 2009/(152/09) Mashi 4, Date : 11th July 2009.■ NGC 2013/14 (171/13) Mashi 4, Date 03 Oct. 2013.

Ref. No. : 1940/22   Date : 09 /02 /2022

Date: - 09/02/2022

To,

Dr. Yogita S. Patil,

Assistant Professor

Department of Botany

S.P.H. Mahila College, Malegaon Camp

Tal. Malegaon Dist. Nasik 423105

Subject: Invitation as Guest Lecturer on the occasion of 'Darwin Day' In Botany Department at 'A.C.S. College Ravalgaon'.

Respected Madam,

We plan to celebrate "Darwin Day" dated 12nd February 2022 in the morning 11:00 am. On that occasion we wish to invite you to join us in function as a chief guest and also request you to give a expert lecture on " Darwin's Theory of Evolution "

It would be a great honor and privilege if you would graciously participate in our event. We are anticipating your reply and look forward to spending the day with you and listening to your knowledgeable speech sincerely.

Thanking you.

HEAD,Dept. of Botany
A.C.S. College, Ravalgaon
Tal.Malegaon,Dist-Nashik

Principle
Art's, Commerce & Science College
Ravalgaon Tal, Malegaon (Nasik)
Principal
Art's, Commerce & Science College
Ravalgaon,Tal.Malegaon (Nashik)

Shree Swami Samarth Vidya Prasarak Mandal
Dangsaundane, Tal. : Baglan, Dist. Nashik Sanchalit

ARTS, COMMERCE & SCIENCE COLLEGE,
Ravalgaon, Tal. Malegaon, Dist. Nashik-423108
8275115556 acscollegeravalgaon@gmail.com sssvpm2013@gmail.com

ID No.: PU/NS/A-140/2009

Grand No.: NGC 2009/(152/09) Mashi 4, Date : 11th July 2009, NGC 2013/14 (171/13) Mashi 4, Date 03 Oct. 2013,

Ref. No. : 1960/22

Date : 12/02/2022

To.
Dr. Yogita S.Patil
S.P.H. Mahila Mahavidyalay,
Malegaon Camp,
Dist. Nashik,

Subject:-Letter of Gratitude..........

Respected Madam,

Thank you for your attendance at the Chief Guest in Darwin's Day Celebration at Art's, Commerce and Science College Ravalgaon (Malegaon) on 12 February 2022

With due respect we express our sincere gratitude to **Dr. Yogita S. Patil** for delivering a guest lecture on Darwin's Day organized in our college. The event was well attended and as guest speaker on the day you played a significant role in the success of the day.

Thank you again for your contribution to the function.

With regards,

Principal

Principal
Art's, Commerce & Science College
Ravalgaon,Tal.Malegaon (Nashik)

डार्विन्स सिद्धांतामुळेच सजीव उत्पत्तीचे गूढ शोधणे शक्य

प्रा. योगिता पाटील : रावळगाव महाविद्यालयात डार्विन्स डे उत्साहात

सकाळ वृत्तसेवा

मालेगाव, ता. १५ : डार्विन उत्क्रांतिवादाचा जनक समजले जाते. डार्विन आणि उत्क्रांतिवाद हे जणू एक समीकरणच मानले जाते. उत्क्रांती म्हणजे निसर्गानुसार सजीवांमध्ये होणारे आणि खूपच हळूहळू अंगिकारले जाणारे बदल होय. पृथ्वीच्या उत्पत्तीपासून होत आलेले हे बदल सजीवांच्या उदयास अनुकूल होते, असे मत महिला महाविद्यालयाच्या प्रा. योगिता पाटील यांनी केले.

रावळगाव येथील कला, वाणिज्य व विज्ञान महाविद्यालयात डार्विन्स डे साजरा करण्यात आला. त्यावेळी ते बोलत होते.

डॉ. पाटील म्हणाल्या, चार्ल्स रॉबर्ट डार्विन यांचा जन्म १२ फेब्रुवारी १८०९ साली इंग्लंड येथील शॉर्पशायर शहरातील श्रेब्स्बुरी येथे झाला.

रावळगाव : महाविद्यालयात डार्विन्स डे कार्यक्रमात मार्गदर्शन करताना प्रा. योगिता पाटील. व्यासपीठावर अध्यक्ष सुरेश वाघ, प्राचार्य प्रा. एन. एल. सोनवणे आदी.

त्यांनी मांडलेल्या उत्क्रांतिवादाच्या सिद्धांताने जगातील जीवसृष्टीच्या उत्पत्ती व विकासाची कशी प्रगती होत गेली हे शास्त्रशुद्धरीत्या श्रीमती पाटील यांनी उलगडून दाखवले. डार्विनप्रणीत उत्क्रांतीच्या सिद्धांताचा पाया 'नैसर्गिक निवड' हा आहे. त्याच्या मुळाशी दोन साध्या संकल्पना आहेत. एक सर्व सजीवांमध्ये जगण्यासाठीचा संघर्ष व त्यासाठीची स्पर्धा हे तीव्र असतात. कारण जगण्याची संसाधने (उदा. अन्न) मर्यादित असतात, तर लोकसंख्यावाढीचा दर अनियंत्रित असतो. आपल्या आजूबाजूला घडत असणाऱ्या घटनांवर लक्ष दिले असता त्यामध्ये कसे बदल होतात हे आपल्याला कळते. त्यामधूनच विद्यार्थ्यांमध्ये संशोधक वृत्ती निर्माण होते, असे त्या म्हणाल्या.

यावेळी संस्थेचे अध्यक्ष सुरेश वाघ प्रमुख पाहुणे होते. प्राचार्य प्रा. एन. एल. सोनवणे अध्यक्षस्थानी होते. वनस्पतीशास्त्र विभाग प्रमुख प्रा. अदिती काळे यांनी प्रास्ताविक केले. प्रा. जितेंद्र मिसर यांनीही मार्गदर्शन केले. वनस्पतीशास्त्र विभागातर्फे भित्तीचित्र, रांगोळी स्पर्धा, ऑनलाईन प्रश्नमंजुसा, मॉडेल बनवणे आदी स्पर्धा घेण्यात आल्या. श्रीमती पाटील यांनी विद्यार्थ्यांचे पोस्टर व मॉडेल्स व रांगोळींचे परीक्षण केले. स्पर्धांमध्ये विद्यार्थ्यांनी उत्साहाने सहभाग नोंदवला. विद्यार्थ्यांनी ६० पोस्टर, मॉडेल्स व रांगोळ्या साकारल्या.

रांगोळी स्पर्धेत प्रतीक्षा देवरे, नूतन मोरे, निकिता सोनवणे, मॉडेल मेकिंग स्पर्धेत नूतन मोरे, दर्शन शिंदे, साक्षी चव्हाण यांनी अनुक्रमे प्रथम, द्वितीय व तृतीय क्रमांक मिळविला. या वेळी झाडे लावा झाडे जगवा, पृथ्वी वाचवा असा संदेश देण्यात आला. प्रा. सोनाली निकम यांनी सूत्रसंचालन केले. बी. के. आहेर यांनी आभार मानले.

4. Dr. Deepanjali Borse
KTHM College Nashik-02

Maratha Vidya Prasarak Samaj's

K.R.T. Arts, B.H. Commerce &
A.M. Science College, Nashik.
(KTHM College)

Dr. V. B. Gaikwad
M.Sc., M.Phil, Ph.D
Principal

Gangapur Road, Shivaji Nagar, Nashik - 422 002. (M.S.) India. Office : 0253-2571376, Fax : 2577381, (R) 2571502

- College with Potential for Excellence Status by UGC, New Delhi.
- Best College Award of Savitribai Phule Pune University.
- DBT Star College.
- Affiliated to SPP University [ID No. PU/NS/ASC/012(1969)]
- Junior College Index No. J-13.17.001
- DST-FIST Sponsored.
- UGC Sponsored B.Voc. Programme & Community College.

Ref.No. : 328 / 21-22

Date : 18/8/21

To

Dr. Deepanjali Borse
Assistant Professor of English
Smt. Pushpatai Hiray ASC Women's College
Malegaon, Dist. Nashik

Subject: Thanking letter….

Dear Madam,

This is to express our deep sense of gratitude towards you for accepting our invitation and delivering one session in the coursework on the topic 'Eco-criticism and Literary Research' between 3.30 pm and 5.00 pm on 13 August, 2021.

Thank you.

Dr. V. B. Gaikwad
Principal

E-mail : dr.gaikwadvb@rediffmail.com / contact@kthmcollege.com / website : www.kthmcollege.ac.in

5. Dr. P.S. Survase
Tata Institute of Social Science Osmanabad

टाटा सामाजिक विज्ञान संस्थान
Tata Institute of Social Sciences
(Tuljapur Campus)

TISS
RE-IMAGINING FUTURES

To

Dr. Pradnya A. Survase

Assistant Professor

Department of Mathematics,

Mahilaratna Pushpatai Hiray Arts, Sciences and

Commerce Mahila Mahavidyalaya,

Malegaon, Dist: Nashik-423 105.

Date: August 02, 2021

Subject: Invitation for Guest Lecture --- Reg.

Dear Madam,

Greetings!

This gives us immense pleasure to invite you to deliver a guest lecture on "**Application of Mathematics in Economics**" on August 13, 2021 at **Tata Institute of Social Sciences Tuljapur Campus Tuljapur Dist: Osmanabad**. Surly this lecture will benefit to our students to get in-depth knowledge of the subject.

Thanks once again.

Thanking you,

Gunvant A Birajdar

BASS- Coordinator

Tata Institute of Social Sciences

Tuljapur, Dist: Osmanabad-413601.

टाटा सामाजिक विज्ञान संस्थान
Tata Institute of Social Sciences
(Tuljapur Campus)

T I S S

To

Dr. Pradnya A Survase

Assistant Professor

Department of Mathematics,

Mahilaratna Pushapatai Hiray Arts, Sciences and

Commerce Mahila Mahavidyalaya

Malegaon, Dist: Nashik-423 105.

Date: August 03, 2021

Subject: Appreciation letter---Reg

Dear Mam,

Greetings!

We are pleased to express our sincere thanks for such a wonderful, informative, and in-depth lecture on the **"Application of Mathematics in Economics"** at Tata Institute of Social Sciences Tuljapur, Dist: Osmanabad.

We are looking forward to your further intervention on the same.

Thanks

Yours faithfully.

Dr. Gunvant A Birajdar

BASS -Coordinator

Tata Institute of Social Sciences Tuljapur.

डाक पेटी क्रमांक 9
अपसिंगा रोड, ता. तुळजापूर 413601
जिला – उस्मानाबाद
Post Box No 9
Apsinga Road, Tal. Tuljapur 413601

दूरभाष Telephone: 09270105222 / 23 / 24 / 25 / 26
वेबसाइट Website: www.tiss.edu

A Deemed University established under
Section 3 of the UGC Act, 1956, vide
Notification No. F11-22/62-U2, dated

6. Dr. Deepanjali Borse
Arts & Science College Mhasdi Dist. Dhule

Adishakti Dhandai Mata Shikshan Prasarak Sanstha's
Late Annasaheb R.D.Deore Arts and Science College, Mhasadi
Tal-Sakri, Dist-Dhule (M.S)424304
NAAC- B Grade (CGPA-2.41)

Dr.S.R.Patil
Principal
Cell- १४३००६९६०८
Off.०२५६८-२०५६३५,२७५५६०
E-mail-principal.admsps@yahoo.co.in
Customer No- १०११०००५५

Out Ward No: एडीएमएस/हस्तेदेय/2019-2020

डॉ.सुभाष रुपचंद पाटील
प्राचार्य
भ्रमणध्वनी– १४३००६९६०८
कार्यालय-०२५६८-२७५६३५,२७५५६०
website : www.admsps.org

Date-११/०१/२०२०

प्रति,

मा.प्रा.डॉ.दिपांजली बोरसे

एम.एस.जी महाविदयालय मालेगांव

विषय :- युवती सभेअंतर्गत विदयार्थींनी व्यक्तीमत्व् विकास कार्यशाळेस मार्गदर्शन

करणे बाबत..

महोदय,

उपरोक्त् विषयास अनुसरुन आमच्या महाविदयालयात क.ब.चौ.उ.म.विदयापीठ जळगांव
विदयार्थी विकास विभाग व स्वर्गीय अण्णासाहेब आर.डी.देवरे कला व विज्ञान महाविदयालय
म्हसदी यांच्या संयुक्त् विदयमाने युवतीसभे अंतर्गत एकदिवसीय विदयार्थींनी व्यक्तीमत्व् विकास
कार्यशाळा सोमवार दि.१३/०१/२०२० रोजी आयोजित करण्यात आली आहे सदर कार्यशाळेत सकाळी
ठिक 12.00 ते 1.00 या वेळेत मार्गदर्शन करुन महाविदयालयास सहकार्य करावे.

प्राचार्य डॉ.सु.रु.पाटील
प्राचार्य
आदिशक्ती धनदाई माता शिक्षण संस्थेचे
स्वर्गीय अण्णासाहेब आर.डी.देवरे
कला व विज्ञान महाविद्यालय,म्हसदी
ता.साक्री जि.धुळे

सोबत-कार्यक्रम पत्रिका

Adishakti Dhandai Mata Shikshan Prasarak Sanstha's
Late Annasaheb R.D.Deore Arts and Science College, Mhasadi
Tal-Sakri, Dist-Dhule (M.S)424304
NAAC- B Grade (CGPA-2.41)

Dr.S.R.Patil
Principal

Cell- ९४२००६१६०८

Off.०२५८८-२७५६८५,२७५५९०
E-mail-principal.admsps@ynhoo.co.in
Customer No- १०११०००९५

Out Ward No: एडीएमएस/हस्तेदेय/2019-2020

डॉ.सुभाष रघनंद पाटील
प्राचार्य

भ्रमणध्वनी– ९४२००६१६०८
कार्यालय-०२५८८-२७५६८५,२७५५९०
website : www.admsps.org

Date-११/०२/२०२०

प्रति,

डॉ. दिपांजली बोरसे

मालेगाव

आभारपत्रक

आपण आमच्या महाविद्यालयात क.ब.चौ.उ.म.विदयापीठ जळगांव विदयार्थी विकास विभाग व स्वर्गीय अण्णासाहेब आर.डी.देवरे कला व विज्ञान महाविदयालय म्हसदी यांच्या संयुक्त् विदयमाने युवतीसभे अंतर्गत एकदिवसीय विदयार्थीनी व्यक्तीमत्व् विकास कार्यशाळा सोमवार दि.११/०२/२०२० रोजी आयोजित करण्यात आली होती. त्या अनुषंगाने आपण मार्गदर्शक म्हणुन उपस्थित राहुन महाविदयलायास सहकार्य केल्याबददल महाविद्यालय आपले सदैव ऋणी राहील.

प्राचार्य डॉ.सु.रु.पाटील

2) Research Paper

List of Research Paper

SN	Faculty	Activity
1	Dr. P. A. Survase	Research Paper published in collaboration
2	Dr. P. A. Survase	Research Paper published in collaboration
3	Shri. Atul S. Kale	Research Paper published in collaboration

1) Dr. P. S. Survase

Study of Some Results on Open Subset Inclusion Graph of a Topological Space

P. A. Suravase[1]

Department of Mathematics

Mahilaratna Pushpatai Hiray Arts, Science and Commerce Mahila Mahavidyalaya,

Malegaon Dist. Nasik (MS), India

survase.pradnya5@gmail.com

R. A. Muneshwar[2]

P. G. Department of Mathematics

N.E.S. Science College,

Nanded - 431602, (MH), India

muneshwarrajesh10@gmail.com

K. L. Bondar[3]

P.G. Department of Mathematics

Government Vidarbha Institute of Science and Humanities,

Amravati, Maharashtra, India

klbondar_75@rediffmail.com

Abstract

In the recent paper R. A. Muneshwar and K. L. Bondar introduce a graph topological structure, called open subset inclusion graph of a topological space $y(\tau)$ on a finite set X, where the vertex set is the collection of nonempty proper open subsets of a topological space and two vertices U_1, U_2 are adjacent or $U_1 \sim U_2$ or $(U_1, U_2) \in E$, if either $U_1 \subset U_2$ or $U_2 \subset U_1$. In this present paper, we continue the study of the open subset inclusion graph of a topological space $y(\tau)$ on a finite set X. It is shown that, if τ is a discrete topology defined on nonempty set X with $|X| = n$ then the graph $y(\tau)$ is perfect, and if τ is a discrete topology defined on nonempty set X with $|X| = n \geq 5$ then the graph $y(\tau)$ is non-planar. Also, a necessary and sufficient condition is provided for $y(\tau)$ to be Eulerian. Moreover, if τ_1 and τ_2 are are any two topologies defined on X

2   P. A. Suravase[1], R. A. Muneshwar[2], K. L. Bondar[3]

with $|X| = n$ which are homeomorphic as a topological space then we prove that $\jmath(\tau_1)$ and $\jmath(\tau_2)$ are isomorphic as graph.

Mathematics Subject Classification (2010-MSC): 05C25, 05C12, 05C45, 05C10, 05C17.

Keywords: Discrete Topology, Graph, Eulerian Graph, Perfect Graph and Planer Graph, Isomorphic Graph.

1   Introduction

Graph theory has wide range of applications in various fields. If R is commutative ring with unity then the zero divisor graph of R is firstly introduced by Beck[2]. In the recent decades, graph of the several algebraic structures were defined. Among these graphs, zero divisor graphs of ring and module are more attractive for many researchers. Apart from its combinatorial motivation, graph theory also helps to characterize various algebraic structures by means of studying certain graphs associated to them. Till date, a lot of research, e.g., [3, 9] has been done in connecting graph structures to various algebraic objects. Recently, some work associating graphs with subspaces of vector spaces can be found in [4, 5, 6, 10] A. Kalavathi and G. Sai Sundara Krishnan introduced the concept of soft g*closed sets and soft g* open sets in soft topological space which can be found in [11] .They also discussed the concept of soft and regular spaces and investigate the relationship between them. Some work on Incomparability Graphs of Lattices can be found in [15, 16]. R. A. Muneshwar and K. L. Bondar[12, 13] introduced an Graph of a Topological Space and discussed some properties of these graphs. For undefined terms and concepts the reader is referred to [16]. In[12], authors indroduced the graph $\mho(\tau)$ of τ, which is defined as follows.

Definition 1.1 *Open Subset Inclusion Graph of a Topological Space [12]Let (X, τ) be a finite topological space with topology τ and ϕ denote the empty set. We define a graph $\jmath(\tau)$ = (V, E) as follow: V = Collection of non-empty proper open subsets of a topological space (X, τ) and for $U_1, U_2 \in \tau$, $U_1 \sim U_2$ or $(U_1, U_2) \in E$ if $U_1 \subset U_2$ or $U_2 \subset U_1$.*

2   The graph $\jmath(\tau)$ is an Eulerian graph and Perfect

In this section, we find a necessary and sufficient condition for $\jmath(\tau)$ to be Eulerian graph and Perfect. Throughout this section, we assume that a topological space (X, τ) is a discrete

with $|X| = n = 3$.

Theorem 2.1 *If τ is a discrete topology defined on nonempty set X with $|X| = n$. If U and V are any two non-trivial proper open subsets of X of cardinality k and $(n-k)$ respectively then $deg(U) = deg(V)$ in the graph $\jmath(\tau)$.*

Proof: Let τ is a discrete topology defined on nonempty set X with $|X| = n$. If U and V are any two open subsets of X with $|U| = k$, and $|V| = n - k$. Then by Theorem 6.1[12], we have $deg(U) = (2^k - 2) + (2^{n-k} - 2)$ and $deg(V) = (2^{n-k} - 2) + (2^k - 2)$. Hence the $deg(U) = deg(V)$ in $\jmath(\tau)$.

Theorem 2.2 *If τ is a discrete topology defined on nonempty set X with $|X| = n$, then $\jmath(\tau)$ is an Eulerian graph.*

Proof: Let τ is a discrete topology defined on nonempty set X with $|X| = n$ and U is an open subset of X of cardinality k then $deg(U) = (2^k - 2) + (2^{n-k} - 2) = (2^k + 2^{n-k} - 4)$, which is even number. Thus, all vertices in the graph $\jmath(\tau)$ is of even degree and hence $\jmath(\tau)$ Eulerian graph.

By Theorem 5.4[12], it is shown that, the graph $\jmath(\tau)$ is weakly perfect, i.e. if τ is a discrete topology defined on nonempty set X with $|X| = n$ then $\omega(\jmath(\tau)) = \chi(\jmath(\tau)) = n - 1$. In this section, we show that $\jmath(\tau)$ is a perfect graph, i.e. $\omega(H) = \chi(H)$ for every induced subgraph H of $\jmath(\tau)$. We start by recalling result of Chudnovsky et.al.[7] which is helpful to prove that the graph $\jmath(\tau)$ perfect.

Theorem 2.3 *(Strong Perfect Graph Theorem[7]): A graph G is perfect graph if and only if neither G nor its complement contains an odd cycle of length at least 5 as an induced subgraph.*

Theorem 2.4 *If τ is a discrete topology defined on nonempty set X with $|X| = n$ then $\jmath(\tau)$ has no induced cycle of odd length greater than 3.*

Proof: Let τ is a discrete topology defined on nonempty set X with $|X| = n$. If possible, let $C : W_1 \sim W_2 \sim W_3 \sim \; \sim W_{2k+1} \sim W_1$ be an induced cycle of odd length in $\jmath(\tau)$ with $k \geq 2$. Since $W_1 \sim W_2$, then without loss of generality, we suppose that $W_1 \subset W_2$. Now, since $W_2 \sim W_3$ then we have, $W_2 \subset W_3$ or $W_3 \subset W_2$. However, if $W_2 \subset W_3$ holds, then by

4   P. A. Suravase[1], R. A. Muneshwar[2], K. L. Bondar[2]

transitivity of set inclusion, we have $W_1 \subset W_3$. Hence $W_1 \sim W_3$, a contradiction, as C is an induced cycle of length $2k+1$, with $k \geq 2$ in the graph $\jmath(\tau)$ and therefore, $W_3 \subset W_2$. Proceeding in a similar manner finally we get $W_1 \subset W_2 \supset W_3 \subset W_4 \supset W_5 \subset \quad \supset W_{2k+1} \subset W_1$. However, from this we conclude that $W_{2k+1} \subset W_1 \subset W_2$, which is a cycle of length 3, a contradiction, as C is an induced cycle of length $2k+1$, with $k \geq 2$ in the graph $\jmath(\tau)$. Thus, the graph $\jmath(\tau)$ has no induced cycle of odd length greater than 3.

Theorem 2.5 *If τ is a discrete topology defined on nonempty set X with $|X| = n$ then complement of $\jmath(\tau)$, has no induced cycle of odd length greater than 3.*

Proof: Let τ is a discrete topology defined on nonempty set X with $|X| = n$. If possible, let $C : W_1 \sim W_2 \sim W_3 \sim \quad \sim W_{2k+1} \sim W_1$ be an induced cycle in $\jmath(\tau)^c$ with $k \geq 2$. For sake of definiteness and for further use, let W_{2k+1} be the final vertex in the induced cycle C. Since $W_1 \sim W_2$, therefore we have $W_1 \not\subset W_2$ and $W_2 \not\subset W_1$. On the other hand, as $W_1 \not\sim W_3$, without loss of generality, let us suppose that $W_1 \subset W_3$. As W_1 is also not adjacent to vertex W_4, then we have either $W_1 \subset W_4$ or $W_4 \subset W_1$. But, if $W_4 \subset W_1$ is holds, then by transitivity of set inclusion, we have $W_4 \subset W_3$ and hence $W_3 \not\sim W_4$ in $\jmath(\tau)^c$, a contradiction. Thus, we have $W_1 \subset W_4$. Again $W_2 \not\sim W_4$. then we have, either $W_2 \subset W_4$ or $W_4 \subset W_2$. But, if $W_4 \subset W_2$, then by transitivity of set inclusion, we get $W_1 \subset W_2$. Hence $W_1 \not\sim W_2$ in $\jmath(\tau)^c$, a contradiction and therefore $W_2 \subset W_4$. Also, since $W_2 \not\sim W_5$ then we have, either $W_2 \subset W_5$ or $W_5 \subset W_2$. But, if $W_5 \subset W_2$, then by transitivity of set inclusion, we have $W_5 \subset W_4$ and hence $W_5 \not\sim W_4$ in $\jmath(\tau)^c$, a contradiction. Thus, $W_2 \subset W_5$. Finally, as $W_3 \not\sim W_5$, then we have either $W_3 \subset W_5$ or $W_5 \subset W_3$. If $W_5 \subset W_3$, then by transitivity of set inclusion, we get $W_2 \subset W_3$. Hence $W_2 \not\sim W_3$ in $\jmath(\tau)$, a contradiction. On the other hand, if $W_3 \subset W_5$, then by transitivity of set inclusion, $W_1 \subset W_5$ and hence $W_1 \not\sim W_5$ in $\jmath(\tau)^c$, therefore W_5 is not the final vertex in C. Thus, there exists at least two more vertices W_6 and W_7 in the induced cycle C in $\jmath(\tau)^c$. However, continuing in the same manner, we can show that $W_1 \subset W_7$. Hence $W_1 \not\sim W_7$ in $\jmath(\tau)^c$, and we conclude that W_7 is not the final vertex in C. By the same argument as above, the induced odd cycle C has two more vertices W_8 and W_9. Observe that this process continues indefinitely and hence we cannot get an induced odd cycle of finite length in the graph $\jmath(\tau)^c$, a contradiction to the finiteness of length of cycle C. Thus, $\jmath(\tau)^c$ has no induced cycle of odd length greater than 3.

Theorem 2.6 *If τ is a discrete topology defined on nonempty set X with $|X| = n$ then*

$\jmath(\tau)$ *is perfect graph*

Proof: Let τ is a discrete topology defined on nonempty set X with $|X| = n$. Then by Theorem 2.4, graph $\jmath(\tau)$ has no induced cycle of odd length greater than 3. By Theorem 2.5, graph $\jmath(\tau)^c$ has no induced cycle of odd length greater than 3. Thus by Strong Perfect Graph Theorem 2.3, graph $\jmath(\tau)$ is a perfect graph.

3   Planarity of $\jmath(\tau)$

By Corollary 5.3[12], it is prove that if τ is a discrete topology defined on nonempty set X with $|X| = n > 5$ then $\jmath(\tau)$ is not planar. In this section, we prove that $\jmath(\tau)$ is not planar for $n \geq 5$. Before that we recall a necessary and sufficient condition of a graph to be planar.

Theorem 3.1 *(Wagner's Theorem): A finite graph is planar if and only if its minors include neither K_5 nor $K_{3,3}$.*

Theorem 3.2 *If τ is a discrete topology defined on nonempty set X with $|X| = n = 5$ then $\jmath(\tau)$ is not planar.*

Proof: If τ is a discrete topology defined on nonempty set X with $X = \{a_1, a_2, a_3, a_4, a_5\}$. An inclusion graph $\jmath(\tau)$ of topological space (X, τ) with $|X| = 5$ is shown in figure 1.

Consider the sub graph G of $\jmath(\tau)$ induced by the following open subsets (see Figure 2): $A_1 = \{a_1\}, A_2 = \{a_2\}, A_3 = \{a_3\}, A_{123} = \{a_1, a_2, a_3\}, A_{124} = \{a_1, a_2, a_4\}, A_{135} = \{a_1, a_3, a_5\}, A_4 = \{a_4\}, A_{24} = \{a_2, a_4\}, A_{1234} = \{a_1, a_2, a_3, a_4\}$.

Now we apply edge- contraction on G as follows (see the coloured arrows in Figure 3.
1. Identify A_{135}, A_{24} and A_4 and then identify it with A_2.
2. Identify A_{1234} and then identify it with A_{124}.
The new graph formed after edge-contraction (shown in Figure 4) is $K_{3,3}$ and thus by Theorem 3.1 (Wagner's Theorem), G and hence $\jmath(\tau)$ is not planar graph of discrete topological space (X, τ) with $|X| = 5$.

Theorem 3.3 *If τ is a discrete topology defined on nonempty set X with $|X| = n \geq 5$ then $\jmath(\tau)$ is not planar.*

Proof: Let τ is a discrete topology defined on nonempty set X with $|X| = n \geq 5$.
Case I: If $n > 5$, then by Corollary 5.3[12], $\jmath(\tau)$ is not a planar graph.

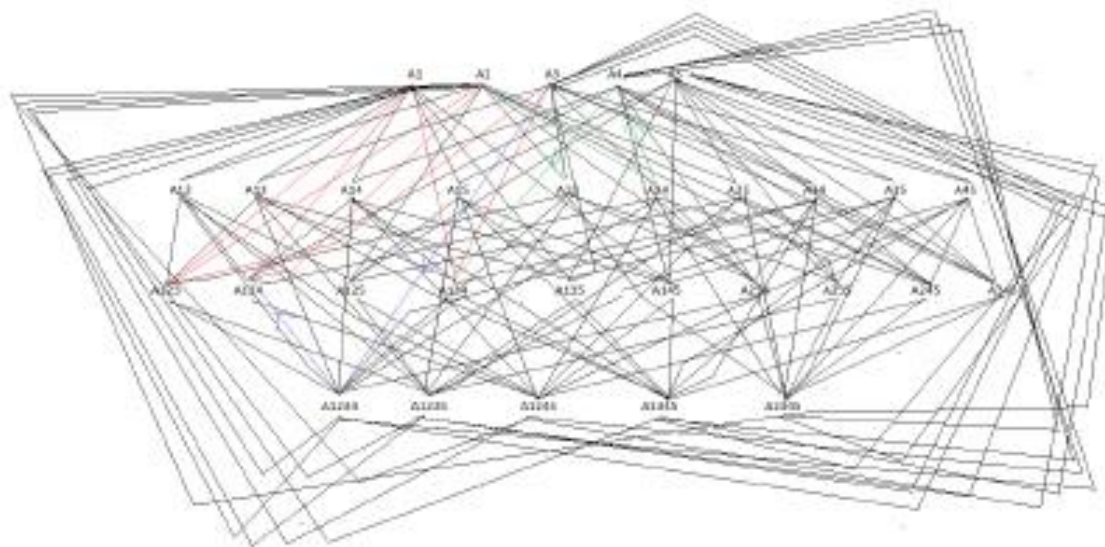6   P. A. Suravase[1], R. A. Muneshwar[2], K. L. Bondar[3]

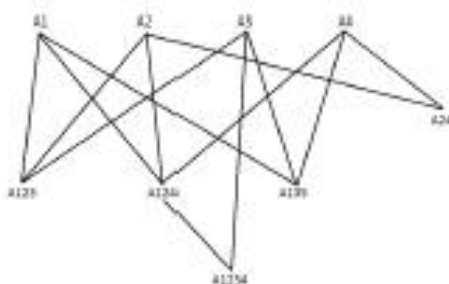Figure 1:   Inclusion Graph $y(\tau)$ of Topological Space (X, τ) with $|X| = 5$.

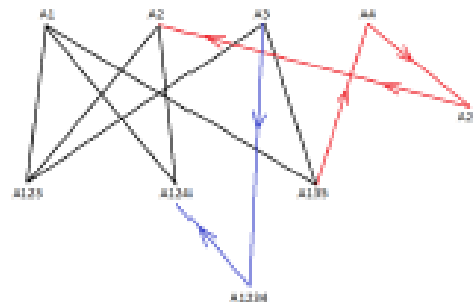Figure 2:   Subgraph G of above Inclusion Graph $y(\tau)$

Figure 3: Before edge contraction Subgraph G of above Inclusion Graph $\jmath(\tau)$
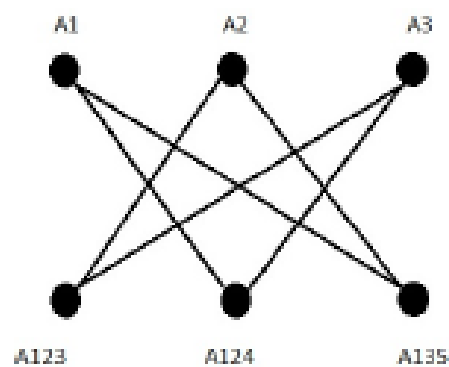
Figure 4: After edge contraction Subgraph G of above Inclusion Graph $\jmath(\tau)$

8 $\qquad$ P. A. Suravase[1], R. A. Muneshwar[2], K. L. Bondar[3]

Case II: If $n = 5$, then By the Theorem 3.2, $y(\tau)$ is not a planar graph.

Thus if (X, τ) is a discrete topological space with $|X| = n \geq 5$ then the graph $y(\tau)$ is not a planar.

Theorem 3.4 *Let τ_1 and τ_2 are any two topologies defined on X with $|X| = n$. If (X, τ_1) and (X, τ_2) are homeomorphic as a topological space then $y(\tau_1)$ and $y(\tau_2)$ are isomorphic as graph.*

Proof: Let (X, τ_1) and (X, τ_2) are any two topological spaces defined on X. If $\Psi : (X, \tau_1) \to (X, \tau_2)$ is a homeomorphism from (X, τ_1) to (X, τ_1), then the map $\Phi : V(\tau_1) \to V(\tau_2)$ by $\Phi(H) = \Psi(H)$, for all $H \in V(\tau_1)$ is a graph isomorphism and hence the result.

4 Conclusion

In this present work, we studied the open subset inclusion graph of a topological space $y(\tau)$ on a finite set X. It is shown that, if τ is a discrete topology defined on nonempty set X with $|X| = n$ then the graph $y(\tau)$ is perfect, and if τ is a discrete topology defined on nonempty set X with $|X| = n \geq 5$ then the graph $y(\tau)$ is non-planar. Moreover a necessary and sufficient condition is provided for the grapoh $y(\tau)$ to be Eulerian. Also, if (X, τ_1) and (X, τ_2) are any two topologies defined on X with $|X| = n$ which are homeomorphic as a topological space then we proved that $y(\tau_1)$ and $y(\tau_2)$ are isomorphic as graph.

Acknowledgment

References

[1] Alspach B.: Hamiltonian cycles in vertex-transitive graphs of order 2p. Proceedings of the Tenth. Southeastern Conference on Combinatorics, Graph Theory and Computing (Florida Atlantic University, Boca Raton (FL), 1979); 1979. p. 131–139. Congress Numer XXIII-XX, Utilitas Math.

[2] I. Beck: Coloring of commutative rings, Journal of Algebra, Vol. No.-116, Issue No. 1, Page No. 208-226

[3] D. F. Anderson and P. S. Livingston: The zero-divisor graph of a commutative ring, Journal of Algebra, 217 (1999), 434-447 .

[4] A. Das: Non-Zero Component Graph of a Finite Dimensional Vector Space, Communications in Algebra, Vol. 44, Issue 9, 2016: 3918-3926.

[5] A. Das: Subspace Inclusion Graph of a Vector Space, Communications in Algebra, Vol. 44, Issue 11, 2016: 4724-4731.

[6] A. Das: On Non-Zero Component Graph of Vector Spaces over Finite Fields, Journal of Algebra and Its Applications, Volume 16, Issue 01, January 2017. 10.

[7] ChudnovskyM, Robertson N, Seymour P, et al.: The strong perfect graph theorem. AnnMath., 2006;164:51–229.

[8] Godsil C, Royle G.: Algebraic graph theory, Graduate text in mathematics. Vol. 207. New York: Springer; 2001.

[9] I. Chakrabarty, S. Ghosh, T.K. Mukherjee, and M.K. Sen: Intersection graphs of ideals of rings, Discrete Mathematics 309, 17 (2009): 5381-5392.

[10] N. Jafari Rad, S.H. Jafari: Results on the intersection graphs of subspaces of a vector space, http://arxiv.org/abs/1105.0803v1.

[11] A. Kalavathi and G. Sai Sundara Krishnan: Soft g* closed and soft g*open sets in soft topological spaces, Journal of Interdisciplinary Mathematics, 19:1, 65-82, DOI: 10.1080/09720502.2015.1103110 .

[12] R. A. Muneshwar, K. L. Bondar, Open Subset Inclusion Graph of a Topological Space. Journal of Discrete Mathematical Sciences and Cryptography, Vol.-22, Issue No.-6, (2019), pp.-1007-1018.

[13] R. A. Muneshwar, K. L. Bondar, Some Significant Properties of the Intersection Graph Derived from Topological Space Using Intersection of Open Sets, Far East Journal of Mathematical Sciences (FJMS), Vol.-119, Issue No.-1, (2019), pp.-29-48.

2) Dr. P. S. Survase

Solving Fractional Riccati Differential Equation by Using Fractional Adomian Decomposition Method and Fractional Differential Transform Method

N. D. More
P.G Department of Mathematics
N.E.S. Science College,
Nanded - 431602, (MH), India

V. B. Paikrao
P.G Department of Physics
N.E.S. Science College,
Nanded - 431602, (MH), India

P. S. Survase
Department of Mathematics
M. P. H. Mahila Mahavidyalaya,Malegaon,
Dist.Nashik-423203, (MH), India

S. M. Pawar*
P.G Department of Mathematics
N.E.S. Science College,
Nanded - 431602, (MH), India

Abstract

In this paper, we using two different methods as FDTM (Fractional Differential Transfrom Method) and FADM (Fractional Adomian Decomposition Method) are carried out for solving non-linear fractional Riccati differential equations. The fractional derivatives are described in the Caputo sense. In these schemes, the solution takes the form of a convergent series with easily computable components. Furthermore, the fractional model solution generated by FDTM is associated with the fractional model solution derived by FADM for different fractional orders. Additionally, Python software is used to analyse the result numerically and graphically.

1   Introduction

Fractional derivatives have a lengthy mathematical history, although they were rarely employed in physics for many years. One reason for this unpopularity might be that fractional derivatives have numerous non-equivalent definitions [7]. Another issue is that, due to their nonlocal nature, fractional derivatives have no obvious geometrical meaning [8]. However, in

2   *N. D. More[1], V. B. Paikrao[2] P. S. Survase[3] , S. M. Pawar*,*

the last twenty years, physicists and mathematicians have begun to pay considerably greater attention to fractional calculus. With the use of fractional derivatives, it was discovered that a variety of applications, particularly multidisciplinary applications, may be elegantly described. For example, fractional derivatives may be used to describe nonlinear seismic oscillations [9], and fractional derivatives can be used to alleviate the inadequacy caused by the assumption of continuous traffic flow in a fluid dynamic traffic model [10].

The theory of fractional derivation has gained a lot of attention in the field of mathematics. There isn't a standard form for defining fractional derivative. However, the most generally used definitions found in [7] . The differential transform method (DTM) is a numerical approach for solving differential equations. Zhou[1], firstly introduced the concept of DTM and by using this new DTM method he solved linear as well as nonlinear IVP in electrical science. Recently, a new analytical technique, named Fractional Differential Transform Method (FDTM), is developed to solve fractional differential equations (FDEs) which can be found in [16]. FDTM forms fractional power series in the same way that DTM forms Taylor series. Many authors have done Studies by using Adomian decomposition method about solutions of different types of systems of fractional differential equations, which can be found in [12, 13, 25, 26].

In this paper, we present numerical approximate and analytical solutions for the fractional Riccati differential equation

$$y^{(\alpha)} = A(t) + B(t)y + C(t)y^2, \quad t > 0, n - 1 < \alpha \leq n \tag{1.1}$$

subject to the initial conditions

$y^k(0) = c_k, \quad k = 0, 1, \ldots, n - 1$, where $A(t), B(t)$ and $C(t)$ are given functions, $c_k, k = 0, 1, \ldots, n - 1$, are arbitrary constants and a is a parameter describing the order of the fractional derivative. The general response expression contains a parameter describing the order of the fractional derivative that can be varied to obtain various responses. In the case of $\alpha = 1$, the fractional equation reduces to the classical Riccati differential equation. The importance of this equation usually arises in the optimal control problems. The feed back gain of the linear quadratic optimal control depends on a solution of a Riccati differential equation which has to be found for the whole time horizon of the control process [12]. The existing literature on fractional differential equations tends to focus on particular values for the order α. The value $\alpha = 1/2$ is especially popular. This is because in classical fractional calculus, many of the model equations developed used these particular orders of derivatives. In modern applications much more general values of the order a appear in the equations and therefore one needs to consider numerical and analytical methods to solve differential equations of arbitrary order.

2   Basic Ideas of the Fractional Differential Transform Mehtod (FDTM)and Fractional Adomian Decomposition Mehtod (FADM)

In this part, we review several key conclusions from the FDTM and FADM both of which are utilised to generate approximate analytical solutions for the in this work (1.1).

2.1   Basic ideas of the FDTM

In this section, we see the fractional differential transform method used in this paper to obtain approximate analytical solutions for the fractional differential equations. This method has been

developed in [17] as follows: The fractional differentiation in Riemann-Liouville sense is defined by

$$D_{z_0}^{q} \varphi(\zeta) = \frac{1}{\Gamma(m-q)} \frac{d^m}{d\zeta^m} \left[\int_{\zeta_0}^{\zeta} \frac{\varphi(t)}{(\zeta-t)^{1+q-m}} \, dt \right]$$

for $m-1 \leqslant q < m$, $m \in Z^+$, $\zeta > \zeta_0$. Let us expand the analytical and continuous function $\varphi(\zeta)$ in terms of a fractional power series as follows:

$$\varphi(\zeta) = \sum_{k=0}^{\infty} \Phi(k) \, (\zeta - \zeta_0)^{k/\alpha}, \qquad (2.1.1)$$

where α and $\Phi(k)$ are the order of fraction and FDT of $\varphi(\zeta)$ respectively.
In order to avoid fractional initial and boundary conditions, we define the fractional derivative in the Caputo sense. The relation between the Riemann-Liouville operator and Caputo operator is given by

$$D_{*\zeta_0}^{q} \varphi(\zeta) = D_{\zeta_0}^{q} \left[\varphi(\zeta) - \sum_{k=0}^{m-1} \frac{1}{k!} (\zeta - \zeta_0)^k \varphi^{(k)} (\zeta_0) \right].$$

Setting $f(\zeta) = \varphi(\zeta) - \sum_{k=0}^{m-1} \frac{1}{k!} (\zeta - \zeta_0)^k \varphi^{(k)} (\zeta_0)$ in Eq. (2.1) and using Eq. (2.3), we obtain fractional derivative in the Caputo sense [17] as follows:

$$D_{*\zeta_0}^{q} \varphi(\zeta) = \frac{1}{\Gamma(m-q)} \frac{d^m}{d\zeta^m} \left\{ \int_{\zeta_0}^{\zeta} \left[\frac{\varphi(t) - \sum_{k=0}^{m-1} (1/k!) (t - \zeta_0)^k \varphi^{(k)} (\zeta_0)}{(\zeta-t)^{1+q-m}} \right] dt \right\}$$

Let fractional IVP, in terms of the Caputo sense are as fallows.

$$\Phi(k) = \begin{cases} \text{If } k/\alpha \in Z^+, \frac{1}{(k/\alpha)!} \left[\frac{d^{k/\alpha} \varphi(\zeta)}{d\zeta^{k/\alpha}} \right]_{\zeta = \zeta_0} & \text{for } k = 0, 1, 2, \ldots, (q\alpha - 1) \\ \text{If } k/\alpha \notin Z^+ & 0, \end{cases} \qquad (2.1.2)$$

where, q denotes the order of the fractional differential equation under consideration. Now we recall some important theorems of FDTM which can be used to find an analytical solution of model.

Theorem 2.1 *If $\varphi(\zeta) = \psi(\zeta) \pm w(\zeta)$, then $\Phi(k) = \Psi(k) \pm \omega(k)$.*

Theorem 2.2 *If $\varphi(\zeta) = \psi(\zeta) w(\zeta)$, then $\Phi(k) = \sum_{l=0}^{k} \Psi(l) \omega(k - l)$.*

Theorem 2.3 *If $\varphi(\zeta) = \psi_1(\zeta) \psi_2(\zeta) \ldots \psi_{n-1}(\zeta) \psi_n(\zeta)$, then*

$$\Phi(k) = \sum_{k_{n-1}=0}^{k} \sum_{k_{n-2}=0}^{k_{n-1}} \cdots \sum_{k_2=0}^{k_3} \sum_{k_1=0}^{k_2} \Psi_1(k_1) \Psi_2(k_2 - k_1) \ldots \Psi_{n-1}(k_{n-1} - k_{n-2}) \Psi_n(k - k_{n-1})$$

Theorem 2.4 *If $\varphi(\zeta) = (\zeta - \zeta_0)^r$, then $\Phi(k) = \delta(k - \alpha r)$ where,*

$$\delta(k) = \begin{cases} 1 & \text{if } k = 0 \\ 0 & \text{if } k \neq 0 \end{cases}$$

Theorem 2.5 *If $\varphi(\zeta) = D_{\zeta_0}^{q}[\psi(\zeta)]$, then $\Phi(k) = \frac{\Gamma(q+1+k/\alpha)}{\Gamma(1+k/\alpha)} \Psi(k + \alpha q)$.*

.

4   N. D. More[1], V. B. Paikrao[2] P. S. Survase[3] , S. M. Pawar[*],

2.2   Basic ideas of the FADM

Definition 2.6 *A real function $f(x), x > 0$ is said to be in the space $C_\alpha, \alpha \in \mathbb{R}$ if there exists a real number $p(> \alpha)$, such that $f(x) = x^p f_1(x)$ where $f_1(x) \in C[0,\infty)$. Clearly $C_\alpha \subset C_\beta$ if $\beta \leqslant \alpha$.*

Definition 2.7 *A function $f(x), x > 0$ is said to be in the space $C_\alpha^m, m \in N \cup \{0\}$, if $f^{(m)} \in C_\alpha$.*

Definition 2.8 *The left sided Riemann-Liouville fractional integral of order $\mu \geqslant 0$, of a function $f \in C_\alpha, \alpha \geqslant -1$ is defined as*

$$I^\mu f(x) = \frac{1}{\Gamma(\mu)} \int_0^x \frac{f(t)}{(x-t)^{1-\mu}} dt, \mu > 0, x > 0, I^0 f(x) = f(x)$$

Definition 2.9 *Let $f \in C_{-1}^m, m \in N \cup \{0\}$. Then the (left sided) Caputo fractional derivative of f is defined as [7]*

$$D^\mu f(x) = \begin{cases} \left[I^{m-\mu} f^{(m)}(x) \right] & m-1 < \mu \leqslant m, \quad m \in N \\ \frac{d^m f(x)}{dx^m} & \mu = m. \end{cases}$$

Note that [7]

$$I^\mu I^v f = I^{\mu+v} f, \quad \mu, v \geqslant 0, f \in C_\alpha, \alpha \geqslant -1,$$

$$I^\mu x^\gamma = \frac{\Gamma(\gamma+1)}{\Gamma(\gamma+\mu+1)} x^{\gamma+\mu}, \quad \mu > 0, \gamma > -1, x > 0,$$

$$I^\mu D^\mu f(x) = f(x) - \sum_{k=0}^{m-1} f^{(k)}(0^+) \frac{x^k}{k!}, \quad m-1 < \mu \leqslant m.$$

Now have a look at the fractional differential equation [18]

$$D^\alpha y(\zeta) = A(\zeta) + B(\zeta)y + C(\zeta)y^2, \quad \zeta > 0, n-1 < \alpha \leqslant n \qquad (2.2.1)$$

After applying I^α to the equation 2.2.1, we obtain,

$$y = \sum_{k=0}^{n-1} c_k \frac{\zeta^k}{k!} + I^\alpha [A(\zeta) + B(\zeta)y + C(\zeta)y^2], \quad 1 \leqslant i \leqslant n. \qquad (2.2.2)$$

We adopt ADM to solve the equation 2.2.1. Let

$$y = \sum_{m=0}^{\infty} y_m(\zeta), \qquad (2.2.3)$$

and

$$N(y) = \sum_{m=0}^{\infty} A_m, \qquad (2.2.4)$$

where A_m are the Adomian polynomials. By using equations. 2.2.3 and 2.2.4, the equation 2.2.2, can be written as,

$$\sum_{m=0}^{\infty} y_m = \sum_{k=0}^{n-1} c_k \frac{\zeta^k}{k!} + I^\alpha \sum_{m=0}^{\infty} \left[A(\zeta) + B(\zeta) \sum_{m=0}^{\infty} y_m + C(\zeta) \sum_{m=0}^{\infty} A_m \right]. \qquad (2.2.5)$$

Solving Fractional Riccati Differential Equation by FADM and FDTM. 5

This can be expressed as

$$y_0(\zeta) = \sum_{k=0}^{n-1} c_k \frac{\zeta^k}{k!} + I^{\alpha}(A(\zeta)),$$

$$y_{m+1}(\zeta) = I^{\alpha}(B(\zeta)y_n + C(\zeta)A_m), m \geq 0 \qquad (2.2.6)$$

The shortened series can be used to approximate the answer y_t.

$$\varphi_k = \sum_{m=0}^{k-1} y_m, \quad \lim_{k \to \infty} \varphi_k = y_t(\zeta).$$

However, in many cases the exact solution in a closed form may be obtained. Moreover, the decomposition series solutions are generally converge very rapidly.

3   Applications

Example 3.1 *We consider the fractional Riccati equation*

$$y^{(\alpha)} = 1 - y^2 \qquad (3.1)$$

with the initial condition $y(0) = 0$.

$y(t) = \frac{e^{2t^{\alpha}} - 1}{e^{2t^{\alpha}} + 1}$ is the exact solution of this equation.
To derive the solution of above FDE, we use the Adomian decomposition scheme:

$$y_0 = y(0) + I^{\alpha}(1) = \frac{1}{\Gamma(\alpha + 1)} t^{\alpha}$$

$$y_{n+1} = -I^{\alpha}(A_n), \quad n \geq 0$$

Using the above recursive relationship, the first few terms of the decomposition series are given by

$$y_0 = \frac{1}{\Gamma(\alpha + 1)} t^{\alpha}$$

$$y_1 = I^{\alpha}(y_0^2) = -\frac{\Gamma(1 + 2\alpha)}{\alpha^2 \Gamma(1 + 3\alpha)} t^{3\alpha}$$

$$y_2 = I^{\alpha}(2y_0 y_1) = \frac{16\Gamma(2\alpha)\Gamma(4\alpha)}{\alpha\Gamma(1 + 3\alpha)\Gamma(1 + 5\alpha)} t^{5\alpha}$$

$$y_3 = I^{\alpha}(2y_0 y_2 + y_1^2) = -\frac{(32\alpha^2\Gamma(2\alpha)\Gamma(4\alpha)\Gamma(1 + 3\alpha) + \Gamma(1 + 2\alpha)^2\Gamma(1 + 5\alpha))\Gamma(1 + 6\alpha)}{\alpha^4\Gamma(1 + 3\alpha)^2\Gamma(1 + 5\alpha)\Gamma(1 + 7\alpha)} t^{7\alpha}$$

The general form of the approximation $y(t)$ is given by

$$y(t) = \frac{1}{\Gamma(\alpha + 1)} t^{\alpha} - \frac{\Gamma(1 + 2\alpha)}{\alpha^2\Gamma(1 + 3\alpha)} t^{3\alpha} + \frac{16\Gamma(2\alpha)\Gamma(4\alpha)}{\alpha\Gamma(1 + 3\alpha)\Gamma(1 + 5\alpha)} t^{5\alpha} \cdots$$

6   N. D. More[1], V. B. Paikrao[2] P. S. Survase[3] , S. M. Pawar[*],

To derive the solution of above FDE, we use the Fractional Differential Transform Method scheme:

By using Theorems 2.4 and 2.5, Eq. (3.1) transforms to

$$Y(k+\alpha\theta) = \frac{\Gamma(1+k/\theta)}{\Gamma(\alpha+1+k/\theta)}\left[\delta(k) - \sum_{k_1}^{k} Y(k_1)Y(k-k_1)\right] \tag{3.2}$$

and using Eq. (2.1.2), initial conditions can be transformed as follows:

$$Y(k) = 0, \quad for \ k = 0, 1, \dots, \alpha\theta - 1 \tag{3.3}$$

Using Eqs. (3.2) and (3.3), Y(k) is obtained for different values of α and then using Eq. (2.1.2), y(x) is evaluated.

$$y(t) = \frac{1}{\Gamma(\alpha+1)}t^\alpha - \frac{\Gamma(1+2\alpha)}{\alpha^2\Gamma(1+3\alpha)}t^{3\alpha} + \frac{16\Gamma(2\alpha)\Gamma(4\alpha)}{\alpha\Gamma(1+3\alpha)\Gamma(1+5\alpha)}t^{5\alpha}\dots$$

The obtained solution of (3.1) above is the fractional power series expansion of the exact solution for the first ten terms.
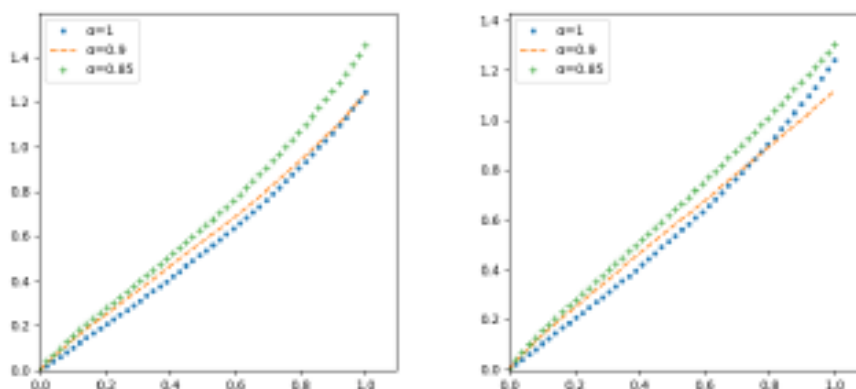
(a) Graph of solution of 3.1 for different value of α by FDTM.   (b) Graph of solution of 3.1 for different value of α by FADM.

Figure 1: Comparision of the fourth iteration approximate solutions of FDTM with the FADM.

Example 3.2 *We consider the fractional Riccati equation*

$$y^{(\alpha)} = 1 + 2y - y^2 \tag{3.4}$$

with the initial condition $y(0) = 0$.

Solving Fractional Riccati Differential Equation by FADM and FDTM.   7

Exact solution of this equation is $y(t) = 1 + \sqrt{2}\tanh\left(\sqrt{2}t + \frac{1}{2}\log\left(\frac{\sqrt{2}-1}{\sqrt{2}+1}\right)\right)$, Following the analysis presented above gives the recurrence relation

$$y_0 = y(0) + I^\alpha(1) = \frac{1}{\Gamma(\alpha+1)}t^\alpha$$

$$y_{n+1} = I^\alpha(2y_n - A_n), \quad n \geq 0,$$

where A_n are Adomian polynomials for the nonlinear term $F(y) = y^2$. Using the above recursive relationship and Mathematica, the first few terms of the decomposition series are given by

$$y_0 = \frac{1}{\Gamma(\alpha+1)}t^\alpha$$

$$y_1 = I^\alpha(2y_0 - y_0^2) = \frac{2^{1-2\alpha}\cos(\pi\alpha)\Gamma(1/2-\alpha)}{\sqrt{\pi}\alpha\Gamma(\alpha)}t^{2\alpha} - \frac{2\Gamma(2\alpha)}{\Gamma(\alpha)\Gamma(1+\alpha)\Gamma(1+3\alpha)}t^{3\alpha}$$

$$y_2 = I^\alpha(2y_1 - 2y_0y_1) = \frac{3^{3-2\alpha}\cos(\pi\alpha)\Gamma(1/2-\alpha)}{\sqrt{\pi}\Gamma(\alpha)\Gamma(1+3\alpha)}t^{3\alpha} - \frac{2\Gamma(2\alpha)}{\Gamma(\alpha)\Gamma(1+\alpha)\Gamma(1+4\alpha)}t^{4\alpha}$$
$$+ \frac{4\Gamma(2\alpha)\Gamma(1+4\alpha)}{\Gamma(\alpha)\Gamma(1+\alpha)^\alpha\Gamma(1+3\alpha)\Gamma(1+5\alpha)}t^{5\alpha} + \frac{12\Gamma(-2\alpha)\Gamma(3\alpha)\sin(2\pi\alpha)}{\pi\Gamma(\alpha)\Gamma(1+4\alpha)}t^{4\alpha}$$

and so on. The first eleven terms of the decomposition series are give by

$$y(t) = \frac{1}{\Gamma(\alpha+1)}t^\alpha + \frac{2^{1-2\alpha}\cos(\pi\alpha)\Gamma(1/2-\alpha)}{\sqrt{\pi}\alpha\Gamma(\alpha)}t^{2\alpha} - \frac{2\Gamma(2\alpha)}{\Gamma(\alpha)\Gamma(1+\alpha)\Gamma(1+3\alpha)}t^{3\alpha}\cdots$$

To derive the solution of above FDE, we use the Fractional Differential Transform Method scheme:

By using Theorems 2.4 and 2.5, Eq. (1) transforms to

$$Y(k+\alpha\theta) = \frac{\Gamma(1+k/\theta)}{\Gamma(\alpha+1+k/\theta)}\left[\delta(k) + 2Y(k) - \sum_{k_1}^{k}Y(k_1)Y(k-k_1)\right] \tag{3.5}$$

and using Eq. (2.1.2), initial conditions can be transformed as follows:

$$Y(k) = 0, \quad for \ k = 0, 1, \ldots, \alpha\theta - 1 \tag{3.6}$$

Using Eqs. (3.5) and (3.6), $Y(k)$ is obtained for values of $\alpha = 1/2$ and $\theta = 2$, then using Eq. (2.1.2), $y(x)$ is evaluated.

$$y(t) = \frac{2}{\sqrt{\pi}}t^{1/2} + 2t + \frac{16(\pi-1)}{3\pi^{3/2}}t^{3/2} + \frac{\pi-4}{\pi}t^2 - \frac{32(3\pi^2 + 44\pi - 32)}{45\pi^{5/2}}t^{5/2} + \cdots$$

8   *N. D. More[1], V. B. Paikrao[2] P. S. Survase[3] , S. M. Pawar[*],*
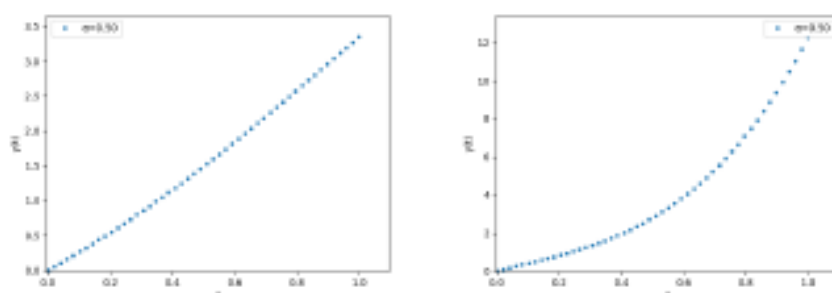
(a) Graph of solution of 3.4 for different value of α by FADM.   (b) Graph of solution of 3.4 for different value of α by FDTM.

Figure 2: Comparision of the fourth iteration approximate solutions of CFDTM with the FDTM and FADM.

4   Conclusion

This work uses FDTM and FADM to solve a non-linear fractional order mathematical model on dengue. Furthermore, the fractional model solution produced by FDTM is associated with the solution of the same model estimated by FADM for different fractional orders. Alternative strategies FADM and FDTM have been used to solve and analyse a non-linear fractional order mathematical model. In terms of infinite series for various orders and by specifying fixed components with various time intervals, an approximate solution to the specified model is established. The Python programme is used to analyse the solution numerically and visually. The outcomes of these numerical simulations have been positive.

References

[1] J.K. Zhou, Differential Transformation and Its Applications for Electrical Circuits, Huazhong University Press, Wuhan, China, 1986 . in Chinese.

[2] A. Arikoglu, I. Ozkol, Solution of fractional differential equations by using differential transform method, Chaos Soliton. Fract. 34(2007) 1473-1481.

[3] Z.M. Odibat, N.T. Shawagfeh, Generalized Taylor's formula, Appl. Math. Comput. 186 (2007) $286 - 293$.

[4] J.S. Duan, Convenient analytic recurrence algorithms for the Adomian polynomials, Appl. Math. Comput. 217 (2011) 6337-6348.

[5] J.S. Duan, Recurrence triangle for Adomian polynomials, Appl. Math. Comput. $216(2010)1235 - 1241$.

[6] Emrah Ünal, Ahmet Gökdoğan, Solution of Conformable Fractional Ordinary Differential Equations via Differential Transform Method, Optik, 264-273 (2017).

3) Dr. Atul S. Kale

RESEARCH ARTICLE

Solubility of Salicylamide in (n-propanol, water) and their binary solvent mixtures at T= (288.15 to 313.15) K

Ramesh R. Pawar[1]*, Atul S. Kale[1], Sachin S. Kale[2]
[1]Department of Chemistry, M.S.G. College, Malegaon Camp, Dist - Nashik (Maharashtra) India
[2]Department of Chemistry, A.S.C. College, Navapur, Dist - Nandurbar (Maharashtra) India
*Corresponding Author E-mail: atulkalemalegaon@gmail.com

ABSTRACT:
The solubility of salicylamide in pure water, n-propanol, and also in water-n-propanol binary mixtures were experimentally measured using a gravimetric method at temperatures (288.15, 291.15, 293.15, 296.15, 298.15, 301.15, 303.15, 306.15, 308.15, 311.15 and 313.15) K. Solubility values was correlated by the modified Apelblat equation. Thermodynamic properties including $\Delta H_{soln}°$, $\Delta G soln°$, and $\Delta S soln°$ of salicylamide in pure and mixed solvents were calculated according to the van't Hoff equation.

KEYWORDS: n-Propanol, Solubility, Binary solvents, Thermodynamics, Apelblat equation.

INTRODUCTION:

Solubility data in aqueous and non-aqueous solvents are providing crucial information for the solid phase properties, preparation of drug formulation and development of pharmaceutical analysis in the drug discovery and development[1-3]. Salicylamide is a slight analgesic with antipyretic and anti-inflammatory properties[4].

Fredrik L. Nordstrom and Ake C. Rosmuson determined solubility of salicylamide in methanol, acetic acid, acetonitrile, acetone, ethyl acetate and water from 10 to 50°C[5]. However there is very little data available for solubility of salicylamide in pure n-propanol and water-n-propanol solvent mixtures.

In the present study, solubility of salicylamide in pure n-propanol, water and water-n-propanol solvent mixtures at 288.15 to 313.15 K are reported.

MATERIAL AND METHODS:
Material:
Salicylamide was provided by Loba chemie with purity 99%. n-propanol Provided by Spectrochem with purity 99.8%.

Apparatus and Procedure:
The solubility of acetanilide was measured using an apparatus similar to that described as in the literature[6-8]. An excess amount of salicylamide was added to the binary solvent mixture prepared by weight (Scale-Tec) with an accuracy of ± 0.0001g, in a specially designed 100 ml double jacketed flask. Water was circulated at constant temperature between the outer and inner walls of the flask. The temperature of the circulating water was controlled by thermostat within (±0.1) K. The solution was continuously stirred using a magnetic stirrer for long time so that equilibrium is assured, and the temperature of solution is same as that of circulating water; the stirrer was switched off; and the solution was allowed to stand for 2 hour to ensure complete settlement of un-dissolved suspended substance. Then a fixed quantity of the supernatant liquid was withdrawn from the flask in a weighing bottle with the help of pipette which is hotter than the solution. The mass of solution were weighed by electronic analytical balance, and kept in an oven at 343 K until constant sample weight. The solubility has been calculated using weight of solute and weight of solution. The experiment was repeated three times and the average value were used to calculate the mole fraction solubility(x_B) of salicylamide.

RESULTS AND DISCUSSION:
Solubility data:
Table 1 reports the experimental and calculated (using Apelblat equation) values of solubility (x_B) of salicylamide at 288.15 to 313.15 K in water + n-propanol. Variation of solubility with x_C^0 is visually shown in Figures 1.

Table 1: Experimental $x_{B(exp.)}$ and calculated $x_{B(cal.)}$ mole fraction solubility of salicylamide for various initial mole fractions, x_C^0, of n-propanol at temperatures (288.15 to 313.15) K.

T/K	x_C^0	$x_{B(exp.)}$ $\times 10^{-2}$	$x_{B(cal.)}$ $\times 10^{-2}$	RD $\times 10^{-2}$	T/K	$x_{B(exp.)}$ $\times 10^{-2}$	$x_{B(cal.)}$ $\times 10^{-2}$	RD $\times 10^{-2}$
288.15	0.0000	0.0029	0.0037	-0.2827	303.15	0.0361	0.0394	-0.0910
	0.0322	0.0194	0.0183	0.0594		0.0858	0.0862	-0.0047
	0.0697	0.1147	0.1131	0.0133		0.3156	0.3116	0.0126
	0.1139	0.3569	0.3586	-0.0048		0.7602	0.7659	-0.0076
	0.1666	0.7201	0.7197	0.0006		1.3673	1.3645	0.0020
	0.2306	1.1593	1.1539	0.0047		2.0807	2.0877	-0.0034
	0.3102	1.6634	1.6792	-0.0095		2.9147	2.9294	-0.0051
	0.4116	2.2963	2.2933	0.0013		3.8246	3.8320	-0.0019
	0.5453	2.8803	2.8793	0.0003		4.6647	4.6694	-0.0010
	0.7296	3.1069	3.1476	-0.0131		4.9407	4.9803	-0.0080
	1.0000	2.3997	2.3639	0.0149		4.2163	4.0894	0.0301
291.15	0.0000	0.0069	0.0073	-0.0563	306.15	0.0394	0.0468	-0.1882
	0.0322	0.0231	0.0266	-0.1511		0.1037	0.1072	-0.0338
	0.0697	0.1386	0.1407	-0.0150		0.3730	0.3732	-0.0005
	0.1139	0.4192	0.4210	-0.0044		0.8673	0.8806	-0.0153
	0.1666	0.8160	0.8172	-0.0016		1.5493	1.5524	-0.0020
	0.2306	1.2895	1.2990	-0.0073		2.3406	2.3507	-0.0043
	0.3102	1.8706	1.8698	0.0004		3.2887	3.2912	-0.0008
	0.4116	2.5318	2.5365	-0.0019		4.2651	4.2571	0.0019
	0.5453	3.1706	3.1719	-0.0004		5.1409	5.1424	-0.0003
	0.7296	3.4013	3.4035	-0.0006		5.4321	5.5636	-0.0242
	1.0000	2.6460	2.6641	-0.0069		4.4042	4.4995	-0.0216
293.15	0.0000	0.0176	0.0109	0.3811	308.15	0.0458	0.0500	-0.0902
	0.0322	0.0340	0.0335	0.0158		0.1239	0.1221	0.0147
	0.0697	0.1591	0.1620	-0.0180		0.4134	0.4194	-0.0144
	0.1139	0.4685	0.4674	0.0024		0.9611	0.9644	-0.0034
	0.1666	0.8920	0.8897	0.0026		1.6942	1.6922	0.0012
	0.2306	1.4064	1.4058	0.0004		2.5401	2.5442	-0.0016
	0.3102	2.0318	2.0111	0.0102		3.5561	3.5599	-0.0010
	0.4116	2.7045	2.7144	-0.0036		4.5773	4.5683	0.0020
	0.5453	3.3737	3.3833	-0.0028		5.4722	5.4837	-0.0021
	0.7296	3.6366	3.5998	0.0101		6.0108	6.0092	0.0003
	1.0000	2.8597	2.8769	-0.0060		4.7134	4.7839	-0.0150
296.15	0.0000	0.0198	0.0180	0.0893	311.15	0.0519	0.0511	0.0148
	0.0322	0.0504	0.0461	0.0846		0.1414	0.1451	-0.0261
	0.0697	0.2019	0.1989	0.0153		0.4956	0.4968	-0.0022
	0.1139	0.5511	0.5447	0.0116		1.1011	1.1018	-0.0006
	0.1666	1.0112	1.0110	0.0002		1.9268	1.9261	0.0004
	0.2306	1.5810	1.5828	-0.0012		2.8724	2.8645	0.0028
	0.3102	2.2714	2.2467	0.0109		3.9368	4.0094	-0.0184
	0.4116	3.0233	3.0071	0.0054		5.0701	5.0811	-0.0022
	0.5453	3.7332	3.7269	0.0017		6.0232	6.0380	-0.0025
	0.7296	3.9978	3.9381	0.0149		6.7201	6.7764	-0.0084
	1.0000	3.1333	3.2149	-0.0260		5.1961	5.2263	-0.0058
298.15	0.0000	0.0230	0.0238	-0.0364	313.15	0.0602	0.0495	0.1771
	0.0322	0.0558	0.0561	-0.0060		0.1641	0.1604	0.0224
	0.0697	0.2277	0.2270	0.0029		0.5573	0.5542	0.0056
	0.1139	0.6077	0.6018	0.0098		1.2141	1.2018	0.0101
	0.1666	1.0951	1.1012	-0.0056		2.0982	2.1000	-0.0008
	0.2306	1.7086	1.7131	-0.0026		3.0974	3.1000	-0.0009
	0.3102	2.4216	2.4213	0.0001		4.4248	4.3436	0.0184
	0.4116	3.2332	3.2212	0.0037		5.4608	5.4565	0.0008
	0.5453	3.9887	3.9750	0.0034		6.4588	6.4378	0.0032
	0.7296	4.2442	4.1966	0.0112		7.5073	7.3635	0.0192
	1.0000	3.3686	3.4527	-0.0250		5.5702	5.5312	0.0070
301.15	0.0000	0.0321	0.0333	-0.0366				
	0.0322	0.0739	0.0733	0.0076				
	0.0697	0.2750	0.2752	-0.0004				
	0.1139	0.6977	0.6964	0.0019				
	0.1666	1.2562	1.2522	0.0032				
	0.2306	1.9550	1.9289	0.0133				
	0.3102	2.6977	2.7130	-0.0057				

580

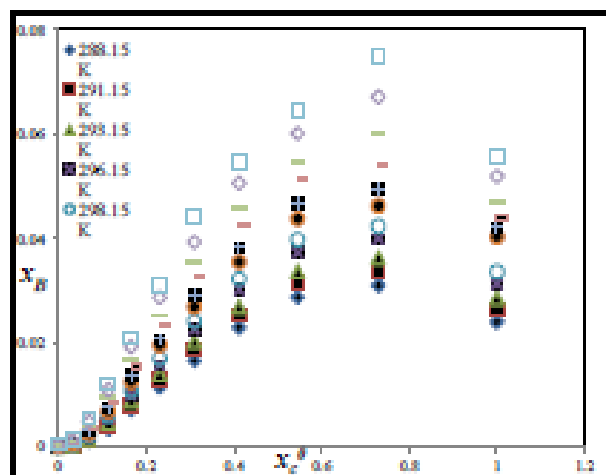|			
0.4116	3.5546	3.5739	-0.0054
0.5453	4.3801	4.3783	0.0004
0.7296	4.6310	4.6410	-0.0022
1.0000	4.0342	3.8276	0.0512

Fig. 1: Plot of mole fraction solubility (x_B) of salicylamide versus initial mole fraction (x_C^0) of n-propanol at temperatures (288.15 to 313.15) K.

The solubility of salicylamide increases with increasing temperature. Salicylamide is an organic compound; naturally the solubility is more in n-propanol as compared with water. In mixed solvents with water as the proportion of organic solvent increases, as expected the solubility also increases.

Modified Apelblat Equation:

The modified Apelblat equation can be expressed as equation 1[9, 10] which is semi-empirical equation; it describes the relation between solubility and temperature.

$$ln x_B = A + \frac{B}{T} + C \ln T \tag{1}$$

A, B, and C are the parameters of the equation and T is temperature in Kelvin. The value A and B represents the variation in the solution coefficient and the C value represents the effect of temperature on the fusion enthalpy. Relative deviation (RD)[11] was calculated using equation 2.

$$RD = \frac{x_B^{exp} - x_B^{cal}}{x_B^{exp}} \tag{2}$$

From table 1 it can be seen that there is an excellent agreement between experimental and calculated values of mole fraction solubility. The values of parameters A, B and C along with co-relation coefficient (R^2) are listed in table 2.

Table 2: Parameters and correlation coefficient (R^2) of modified Apelblat equation

Solvents	x_C^0	A	B	C	R^2
n-Propanol + Water	0.0000	6223.62	-287097	-924.782	0.9521
	0.0322	1690.09	-82698.7	-249.264	0.9934
	0.0697	243.925	-16071.3	-34.4196	0.9995
	0.1139	85.4697	-7766.18	-11.3266	0.9995
	0.1666	-187.589	4915.71	29.2393	0.9999
	0.2306	-152.204	3603.72	23.8786	0.9997
	0.3102	-258.085	8477.81	39.6536	0.9989
	0.4116	-187.867	5601.94	29.0724	0.9998
	0.5453	-117.941	2670.10	18.5623	0.9999
	0.7296	-547.644	21779.7	82.7407	0.9978
	1.0000	180.237	-10830.7	-25.8488	0.9924

Thermodynamic functions of dissolution:

According to the van't Hoff equation, the standard molar enthalpy change of solution ΔH_{sol}^0 is generally obtained from the slope of the $ln x_B$ versus $(1/T - 1/T_{hm})$ plot. Average temperature T_{hm} is introduced to obtain a single value of ΔG_{sol}^0 and ΔS_{sol}^0 in the temperature range studied

$$T_{hm} = \frac{n}{\sum_{i=1}^{n}\left(\frac{1}{T}\right)} \tag{3}$$

Where n is the number of experimental points. In the present work, T_{hm} = 300.8773 K and the temperature range is (288.15 to 313.15) K in both pure solvents and binary solvent mixtures.

Table 3: Slope (m) and intercept (c) of the $ln x_B$ versus $(1/T - 1/T_{hm})$ plot along with R^2.

Salicylamide + n-Propanol + Water			
x_C^0	m	c	R^2
0.0000	-9276	-8.348	0.850
0.0322	-7799	-7.327	0.981
0.0697	-5728	-5.924	0.999
0.1139	-4362	-4.984	0.999
0.1666	-3870	-4.381	0.999
0.2306	-3571	-3.950	0.999
0.3102	-3437	-3.603	0.997
0.4116	-3133	-3.330	0.998
0.5453	-2907	-3.130	0.999
0.7296	-3082	-3.051	0.989
1.0000	-3063	-3.281	0.991

The values of slope and intercept of $ln x_B$ versus $(1/T - 1/T_{hm})$ plot for different solutions including pure solvents and binary solvent mixtures are listed in table 3, form which enthalpy, entropy and standard Gibbs energies of dissolution can be obtained[12].

Table 4: Thermodynamic parameters for salicylamide at mean harmonic temperature T_{hm} = 300.8773 K

x_c^0	$\Delta H_{sol}^0/kJ$ $\cdot K^{-1}\cdot mol^{-1}$	$\Delta G_{sol}^0/kJ$ $\cdot K^{-1}\cdot mol^{-1}$	$\Delta S_{sol}^0/kJ$ $\cdot K^{-1}\cdot mol^{-1}$	$T\Delta S_{sol}^0/kJ$ $\cdot K^{-1}\cdot mol^{-1}$	% ζH	% ζTS
Salicylamide + n-Propanol + Water						
0.0000	77.1265	20.8830	0.1869	56.2435	57.8290	42.1710
0.0322	64.8475	18.3300	0.1546	46.5176	58.2297	41.7703
0.0697	47.6301	14.8206	0.1090	32.8095	59.2123	40.7877
0.1139	36.2715	12.4674	0.0791	23.8040	60.3765	39.6235
0.1666	32.1760	10.9610	0.0705	21.2150	60.2649	39.7351
0.2306	29.6918	9.8829	0.0658	19.8089	59.9826	40.0174
0.3102	28.5778	9.0149	0.0650	19.5628	59.3631	40.6369
0.4116	26.0544	8.3322	0.0589	17.7222	59.5168	40.4832
0.5453	24.1730	7.8319	0.0543	16.3410	59.6657	40.3343
0.7296	25.6254	7.6323	0.0598	17.9931	58.7489	41.2511
1.0000	25.4716	8.2074	0.0574	17.2642	59.6025	40.3975

The relative contribution of enthalpy (ζH) and entropy (ζTS) to Gibbs energy of solution process is calculated by equation 4 and 5 respectively. The results are shown in table 4,

$$\zeta_H = \frac{|\Delta H_{Sol}^0|}{|\Delta H_{Sol}^0| + |T\Delta S_{Sol}^0|} * 100 \quad (4)$$

$$\zeta_{TS} = \frac{|T\Delta S_{Sol}^0|}{|\Delta H_{Sol}^0| + |T\Delta S_{Sol}^0|} * 100 \quad (5)$$

The values of ΔH_{sol}^0 and ΔS_{sol}^0 for all the solutions are positive indicating the solution process as endothermic. The contribution of enthalpy to positive molar Gibbs energy is more as compared to entropy for all solutions.
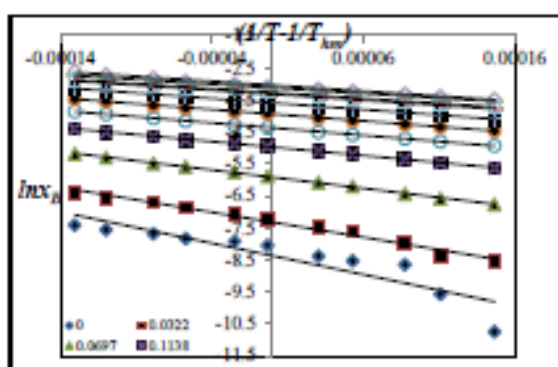

Fig. 2: Plot of lnx_0 versus $(1/T - 1/T_{hm})$ for Salicylamide + water + n-propanol system

CONCLUSION:

This study presents experimental data for the solubility of salicylamide in pure water, n-propanol and binary mixtures of water-n-propanol from (288.15-313.15) K. the solubility of salicylamide in pure and binary solvents increases with upward temperature. The modified Apelblat equation is use to correlate the measured solubility data. The calculated values are satisfactory agreement with the experimental data. The thermodynamic aspects of the solubility process of salicylamide in binary mixtures were studied in order to select the best solvent and optimize its solubility.

REFERENCES:

1. Di L, Fish PV, Mano T. Bridging solubility between drug discovery and development. Drug Discovery Today. 2012; 17: 486-495.
2. Strickley RG. Solubility excipients in oral and injectable formulations. Pharm Res. 2004; 21: 201-230.
3. Alsenz J, Kansy M, High throughput solubility measurement in drug discovery and development. Adv. Drug Delivery Rev. 2007; 59: 546-567.
4. Ullmann F. Encyclopedia of industrial chemistry, Vol. A23, VCH: weinheim, Germany. 1993; 477-483.
5. Fredrik L N and Ake CR. Solubility and melting properties of salicylamide. J. Chem. Eng. Data. 2006; 51: 1775-1777.
6. Pawar RR, Aher CS, Pagar JD, Nikam SL, and Hasan M. Solubility, density and solution thermodynamics of NaI in different pure solvents and binary mixtures. J. Chem. Eng. Data. 2012; 57: 3563-3572.
7. Pawar RR, Nahire SB, Hasan M, Solubility and density of potassium iodide in binary water-ethanol solvent mixtures at298.15, 303.15, 308.15, and 313.15) K. J. Chem. Eng. Data. 2009; 54: 1935–37.
8. Pawar RR, Golait SM, Hasan M, Sawant AB. Solubility and density of potassium iodide in binary water-propan-1-ol solvent mixtures at (298.15,303.15,308.15 and313.15) K. J. Chem. Eng. Data. 2010; 55: 1314–16.
9. Apelblat A, Manzurola E. Solubilities of L-aspartic, DL-aspartic, DL-glutamic, p-hydroxybenzoic, o-anisic, p-anisic and itaconic acid in water from T= 278 K to T=345 K. J. Chem. Thermodyn. 1997; 29: 1527-1533.
10. Apelblat A, Manzurola E. Solubilities of o-acetylsalicylic, 4-aminosalicylic, 3-5-dinitrosalicylic and p-toluic acid and magnesium in water from T= (278 to 348) K. J. Chem. Thermodyn. 1999; 31: 85-91.
11. Wei T, Wang C, Du S. Measurement and correlation of the solubility of penicillin V potassium in ethanol + water and 1-butyl alcohol + water system. J. Chem. Eng. Data. 2015; 60: 112-117.
12. Vehdati S, Shyanfar A, Hanaee J. Solubility of carvedilol in ethanol + propylene glycol mixtures at various temperatures. Ind. Eng. Chem. Res. 2013; 52: 16630-16636.

582

3) Internship/ On job training

List of Internship/on job training

SN	Name of the students	Name of institution for internship/ job training	Year	Duration
01	Ranalkar Priyanka Rajendra	Shree Kakaji Masale	2021-22	22/04/2022 to 07/05/2022
02	Jadhav Dipali Suresh	Shree Suresh Maale	2021-22	22/04/2022 to 07/05/2022
03	Nikam Rupali Dhanraj	Shree Kakaji Masale	2021-22	01/04/2022 to 27/04/2022
04	Chimanpure Bhairavee Kailas	Shree Kakaji Masale	2021-22	04/03/2022 to 27/03/2022
05	Sakat Shital Valmik	Shree Kakaji Masale	2021-22	04/03/2022 to 27/03/2022
06	Salunke Devyani Sanjay	Shree Kakaji Masale	2021-22	22/04/2022 to 07/05/2022
07	Jadhav Kirti Nandu	Shree Kakaji Masale	2021-22	04/03/2022 to 27/03/2022
08	Dangche Vaishnavi Jibhau	Shree Kakaji Masale	2021-22	04/03/2022 to 27/03/2022
09	Golla Vijaya Madhukar	Shree Kakaji Masale	2021-22	09/03/2022 to 27/03/2022
10	Bedase Jayshree Shivdas	Malegaon Municipal Corporation	2021-22	04/03/2022 to 11/03/2022
11	Chavan Divya Ashok	Shree Paras super market	2021-22	01/04/2022 to 28/04/22
12	Gunjal Divya Satish	Shree Paras super market	2021-22	22/04/2022 to23/05/2022
13	Chavan pooja kalidas	Agharkar clothing	2021-22	22/04/2022 to 12/05/2022
14	More priyanka sanjay	Shree Paras super market	2021-22	26/03/2022 to 14/04/2022
15	Khairnar girija nilesh	MSCB	2021-22	25/03/2022 to 08/04/2022

16	Suryawanshi vijaya ujjan	Om kalyani	2021-22	01/11/2021 to 29/11/2022
17	Dangi priyanka arjun	Lavnya kitchen trolly	2021-22	11/03/2022 to 05/04/2022
18	Martand jayshri ashok	Apla Maharashtra bakery	2021-22	05/12/2021 to 27/12/2021
19	Jagtap krutika bharat	Apla Maharashtra bakery	2021-22	05/12/2021 to 27/12/2021
20	Wagh sujata gokul	Quality cake shop bakery	2021-22	09/04/2022 to 25/04/2022
21	Ahire gaytri yuvraj	Premium chick feeds Pvt. ltd	2021-22	26/08/2021 to 13/10/2022
22	Gosavi nikita rajendra	Quality cake shop bakery	2021-22	09/04/2022 to 25/04/2022
23	Shewale kirti sunil	Amit A. Pawar civil engineering	2021-22	25/03/2022 to 09/04/2022

Internship Permission Letter /Completion certificate; Sample copy

Mahatma Gandhi Vidyamandir's

Founder

SMT. PUSHPATAI HIRAY ARTS, SCIENCE & COMMERCE MAHILA MAHAVIDYALAYA

Loknete Vyankatrao Hiray Marg, Malegaon Camp, Dist.Nashik - 423 105.

NAAC ACCREDITED 'B' GRADE

(Affiliated University of Pune) Id. No. PU/NS/ASC/039/(1990)
Office : (02554) 651548 Fax : (02554) 253241
Website: www.sphcollege.com
E-mail :- principal@sphcollege.com
E-mail :- prin_sph@yahoo.co.in

Prin. Dr. Mrs. UJJWALA S. DEORE
M.A., M.Phil., Ph.D.(Marathi)
Mobile : 09011027604
E-mail :- shiojjwal@gmail.com

Date- 26 - 3 - 22

To,

The Manager(HR), Er. Amit Anil Pawar
engineer & Govt Contractor
.... Co Ltd.

Subject:- Request for inclusion of students of our college for Internship Programme...

Madam / Sir,

Savitribai Phule Pune University has introduced 'Internship Programme' for Third Year B. Com. Students in its revised syllabus.

The purpose of the internship programme is to provide hands-on training and experience to the students about various aspects of business and commercial activities. The internship will also enhance employability of students.

In view of this, I request you to provide following students of our college (List enclosed) with an opportunity for internship in your esteemed organisation.

We would appreciate if you could provide exposure of the following business activities to these students:-

We look forward to a mutually rewarding academic association with your organisation.

Thank you.

Coordinator,
Internship Programme

Sincerely,
PRINCIPAL
S.P.H. Mahila Mahavidyalaya
Malegaon Camp-423 105 (Nashik)

Er. Amit Anil Pawar
Civil Engineer & Govt. Contractor

Criterion 3- Research, Innovations and Extension

3.1.1 Grants received from Government and non-governmental agencies for research projects, endowments in the institution during the last five years (INR in Lakhs)

N	Name of the research project/ endowment	Name of the Principal Investigator/Co-investigator	Department of Principal Investigator	Year of Award	Amount Sanctioned	Duration of the project	Name of the Funding Agency	Type (Government/non-Government
	UGC Research Project Grant							
1	Development of New Synthetic Methodology for Conversion of Nitro Group to Amines as well as Ring Opening of Isoxazolidine ring by using Molybdenum M	Rajashri B. Sawant	Chemistry	2017	285000	16.03.2017 to 31.03.2019	University Grant Commission	Government
2	Preparation and Characterization of Doped and Undoped Synthesized ZnO Thick Films as Gas Sensors.	Miss Salunke V.T.	Physics	2017	397500	24.03.2017 to 31.03.2019	University Grant Commission	Government
3	Synthesis of Heterocyclic Compounds Derived From Chalcones	Nutan V. Sadgir	Chemistry	2017	NA	16.03.2017 to 31.03.2019	University Grant Commission	Government
	Zonal Level Avishkar Competition Grant							
1	Zonal Level Avishkar Competition	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2017-18	10000	2017-18	Savitribai Phule Pune University	non-Government
2	Zonal Level Avishkar Competition	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2018-19	10000	2018-19	Savitribai Phule Pune University	non-Government
3	Zonal Level Avishkar Competition	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2019-20	10000	2019-20	Savitribai Phule Pune University	non-Government
	UGC & Others Grant							
1	Teacher Fellowship	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2017-18	929469	2017-18	University Grant Commission	Government
2	Additional Assistant Grant	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2017-18	278533	2017-18	University Grant Commission	Government
3	Minor Research Project	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2017-18	855000	2017-18	University Grant Commission	Government
4	QIP Seminar	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2018-19	273220	2018-19	Savitribai Phule Pune University	non-Government
5	QIP Equipment	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2017-18	361885	2017-18	Savitribai Phule Pune University	non-Government
6	QIP Equipment	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2018-19	177237	2018-19	Savitribai Phule Pune University	non-Government
7	ARC Grant	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2018-19	10000	2018-19	Savitribai Phule Pune University	non-Government
8	DBT Grant	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nas	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashi	2019-20	4100000	2019-20	DBT	Government

3.1.1 Grants received from Government and non-governmental agencies for research projects, endowments in the institution during the last five years (INR in Lakhs)

SN	Name of the research project/ endowment	Name of the Principal Investigator/Co-investigator	Year of Award	Amount Sanctioned	Name of the Funding Agency
UGC Research Project Grant				
1	Development of New Synthetic Methodology for Conversion of Nitro Group to Amines as well as Ring Opening of Isoxazolidine ring by using Molybdenum Metal	Rajashri B. Sawant	2017	285000	University Grant Commission
2	Preparation and Characterization of Doped and Undoped Synthesized ZnO Thick Films as Gas Sensors.	Miss Salunke V.T.	2017	397500	University Grant Commission
3	Synthesis of Heterocyclic Compounds Derived From Chalcones	Nutan V. Sadgir	2017	NA	University Grant Commission
Zonal Level Avishkar Competition Grant				
1	Zonal Level Avishkar Competition	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashik	2017-18	10000	Savitribai Phule Pune University
2	Zonal Level Avishkar Competition	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashik	2018-19	10000	Savitribai Phule Pune University
3	Zonal Level Avishkar Competition	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashik	2019-20	10000	Savitribai Phule Pune University
UGC & Others Grant				
1	Teacher Fellowship	MPH Arts, Science and Commerce Mahila Mahavidyalaya, Malegaon Camp, Nashik	2017-18	929469	University Grant Commission
2	Additional Assistant Grant	MPH Arts, Science and Commerce Mahila	2017-18	278533	University Grant Commission

Mahatma Gandhi Vidyamandir's

SMT. PUSHPATAI HIRAY ARTS, SCIENCE & COMMERCE MAHILA MAHAVIDYALAYA

Loknete Vyankatrao Hiray Marg, Malegaon Camp, Dist.Nashik - 423 105

NAAC ACCREDITED 'B' GRADE

(Affiliated University of Pune) Id. No. PU/NS/ASC/039/(1990)
Office : (02554) 651548 Fax (02554) 253241
Website : www.sphcollege.com
E-mail - principal@sphcollege.com
E-mail :- prin_sph@yahoo.co.in

Founder

Prin. Dr. Mrs. UJJWALA S. DEORE
M.A., M.Phil., Ph.D.(Marathi)
Mobile : 09011027804
E-mail :- shlojjwal@gmail.com

Date- 25-3-22

To,

The Manager(HR),   manoj. R. Gangurde

M.S.C.B. Co Ltd.
...malegaon

Subject:- Request for inclusion of students of our college for Internship Programme...

Madam / Sir,

Savitribai Phule Pune University has introduced 'Internship Programme' for Third Year B. Com. Students in its revised syllabus.

The purpose of the internship programme is to provide hands-on training and experience to the students about various aspects of business and commercial activities. The internship will also enhance employability of students.

In view of this, I request you to provide following students of our college (List enclosed) with an opportunity for internship in your esteemed organisation.

We would appreciate if you could provide exposure of the following business activities to these students:-

We look forward to a mutually rewarding academic association with your organisation.

Thank you.

Coordinator,
Internship Programme

Sincerely,
PRINCIPAL
S.P.H. Mahila Mahavidyalaya
Malegaon Camp-423 105 (Nashik)

PRUTHAVI ENTERPRISES
M.S.No. 48680
M.C. No. 28075
MALEGAON

Mahatma Gandhi Vidyamandir's

SMT. PUSHPATAI HIRAY ARTS, SCIENCE & COMMERCE MAHILA MAHAVIDYALAYA

Loknete Vyankatrao Hiray Marg, Malegaon Camp, Dist.Nashik - 423 105.

NAAC ACCREDITED 'B' GRADE

(Affiliated University of Pune) Id. No. PU/NS/ASC/039/(1990)
Office : (02554) 651548 Fax : (02554) 253241
Website: www.sphcollege.com
E-mail :- principal@sphcollege.com
E-mail :- prin_sph@yahoo.co.in

Founder

Prin. Dr. Mrs. UJJWALA S. DEORE
M.A., M.Phil., Ph.D.(Marathi)
Mobile : 09011027604
E-mail :- shiojjwal@gmail.com

To,   Date- 22/01/22

The Manager(HR), Sayyed Bateen
---------- Co Ltd.

Subject:- Request for inclusion of students of our college for Internship Programme...

Madam / Sir,

Savitribai Phule Pune University has introduced 'Internship Programme' for Third Year B. Com. Students in its revised syllabus.

The purpose of the internship programme is to provide hands-on training and experience to the students about various aspects of business and commercial activities. The internship will also enhance employability of students.

In view of this, I request you to provide following students of our college (List enclosed) with an opportunity for internship in your esteemed organisation.

We would appreciate if you could provide exposure of the following business activities to these students:-

We look forward to a mutually rewarding academic association with your organisation.

Thank you. **APLA MAHARSHTRA BAKERY**
Muchi Corner, Shivaji Road.
Malegaon-Camp (Dist.Nasik)
Coordinator,
Internship Programme

Sincerely,
Principal
...H. Mahila Mahavidyalaya
Malegaon Camp-423 105 (Nashik)

Mahatma Gandhi Vidyamandir's

SMT. PUSHPATAI HIRAY ARTS, SCIENCE & COMMERCE MAHILA MAHAVIDYALAYA

Loknete Vyankatrao Hiray Marg, Malegaon Camp, Dist.Nashik - 423 105.

NAAC ACCREDITED 'B' GRADE

(Affiliated University of Pune) Id. No. PU/NS/ASC/039/(1990)
Office : (02554) 651548 Fax : (02554) 253241
Website: www.sphcollege.com
E-mail :- principal@sphcollege.com
E-mail :- prin_sph@yahoo.co.in

Founder

Karmaveer Bhausaheb Hiray

Prin. Dr. Mrs. UJJWALA S. DEORE
M.A., M.Phil., Ph.D.(Marathi)
Mobile : 09011027604
E-mail :- shiojjwal@gmail.com

Date- 22/01/22

To,

The Manager(HR), Sayyed Bateen

---------- Co Ltd.

Subject:- Request for inclusion of students of our college for Internship Programme...

Madam / Sir,

Savitribai Phule Pune University has introduced 'Internship Programme' for Third Year B. Com. Students in its revised syllabus.

The purpose of the internship programme is to provide hands-on training and experience to the students about various aspects of business and commercial activities. The internship will also enhance employability of students.

In view of this, I request you to provide following students of our college (List enclosed) with an opportunity for internship in your esteemed organisation.

We would appreciate if you could provide exposure of the following business activities to these students:-

We look forward to a mutually rewarding academic association with your organisation.

Thank you.

APLA MAHARSHTRA BAKERY
Muchi Corner, Shivaji Road,
Malegaon-Camp (Dist.Nasik)
Coordinator,
Internship Programme

Sincerely,
PRINCIPAL
M.P.H. Mahila Mahavidyalaya
Malegaon Camp-423 105 (Nashik)

Mahatma Gandhi Vidyamandir's

SMT. PUSHPATAI HIRAY ARTS, SCIENCE & COMMERCE MAHILA MAHAVIDYALAYA

Loknete Vyankatrao Hiray Marg, Malegaon Camp, Dist.Nashik - 423 105.

NAAC ACCREDITED 'B' GRADE

(Affiliated University of Pune) Id. No. PU/NS/ASC/039/(1990)
Office : (02554) 651548 Fax : (02554) 253241
Website: www.sphcollege.com
E-mail :- principal@sphcollege.com
E-mail :- prin_sph@yahoo.co.in

Founder

Karmaveer Bhausaheb Hiray

Prin. Dr. Mrs. UJJWALA S. DEORE
M.A., M.Phil., Ph.D.(Marathi)
Mobile : 09011027604
E-mail :- shiojjwal@gmail.com

Date- 22/01/22

To,

The Manager(HR), Sayyad Bateen

---------- Co Ltd.

Subject:- Request for inclusion of students of our college for Internship Programme...

Madam / Sir,

Savitribai Phule Pune University has introduced 'Internship Programme' for Third Year B. Com. Students in its revised syllabus.

The purpose of the internship programme is to provide hands-on training and experience to the students about various aspects of business and commercial activities. The internship will also enhance employability of students.

In view of this, I request you to provide following students of our college (List enclosed) with an opportunity for internship in your esteemed organisation.

We would appreciate if you could provide exposure of the following business activities to these students:-

We look forward to a mutually rewarding academic association with your organisation.

Thank you.

APLA MAHARSHTRA BAKERY
Muchi Corner, Shivaji Road,
Malegaon-Camp (Dist.Nasik)
Coordinator,
Internship Programme

Sincerely,
PRINCIPAL
M.P.H. Mahila Mahavidyalaya
Malegaon Camp-423 105 (Nashik)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

S.O.H. Mahila College,

Malegoan (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Wagh Sujata	24	20955896 6976	Cost & Work Alc II
2.	Gosavi Nikita	D2	20951044 6102	Cost & Work Alc II
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory)

Prakash . S dandagaval

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

PPH. Mahila College,

Malegaon. (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Divya Gunjal	33	6116 9496 3135	Marketing Management
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory)

Shree Paras Super Market
8/2, A/2, Behind L S Petrol Pump,
Soygaon Market Line, SOYGAON
8275291801, ☎ 02554-256051

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

.S.P.H..... College,

Maleg.aa.n (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Divyani salunke	13		
2.	Dipali Jadhav	17		
3.	Mayuri baese	9		
4.	Priyanka Ramalkar	49		
5.	bhairavi chimy.	22		
6.	shital skat	23		
7.	Rupali	14		
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOODS

Sincerely

Raju Shah

Proprietor

Name & Signature

(Authorised Signatory)

For SU-BHADRAA SPICES & FOODS

Raju Shah

Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

PPH_Mahila College,

Malegoan_ (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Divya Gunjal	33	6116 9496 3135	Marketing Management
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory)

Shree Paras Super Market
8/2, A/2, Behind Petrol Pump,
Soygaon Market Road, SOYGAON
8275291801 ☎ 02554-256051

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

MPH.Mahila College,

Malegaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Krutika Bharat Jagtap	46	8955 0274 8924	Cost & Works. Accounting
2.	Jayashri Martand	27	4469 4646 7189	Cost & Work Accounting
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Shaikh Shek Aham

Name & Signature

(Authorised Signatory)

Shaikh & Associates
(Civil Engineers)
,, Main Road, Malegaon Camp

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

..M.P.H.M.. College,

..Malegaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Vijaya Suryavanshi	50	227220778757	Costing II & III
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory)

VINAYAK TEXOFINE

Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

S.P.H-------- College,

Malegaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Dipali Jadhav	13		Administration.
2.	Divyani Salunke	17		
3.	Mayuri Borse	9		
4.	bhairavi			
5.	priyanka	49		
6.	Shital Sakai			
7.	Rupali	14		
8.	Namrata Bhyse	18		

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Dipali

Name & Signature

(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,
The Principal,
M. P. h. mahila College,
Malegaon.... (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Girija khairnar	11	89804321 6780	Cost & work glc II
2.	Kirti shewale	15	66475656 0136	Cost & work glc II
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature
(Authorised Signatory)

PRUTHAVI ENTERPRISES
Anand Nagar, Soygaon,
Malegaon (Nashik) 423 203

manoj. R. Gangarde

INTERNSHIP COMPLETION CERTIFICATE

To,
The Principal,
..S.P.I.7... College,
maledaan (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully
Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Namrata Bhuse	18		Busi. Administration
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-
on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of
organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Namrata bhuse

Name & Signature

(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

M.P.H.---- College,

malegaon(Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Shital valmik Saket	23	5329 8094 8467	Business Addministration
2.	Rupali Nikam	14		Business Administration
3.	Devyani Saluke	13		
4.	priynka Ranalkar	49		
5.	pooja chavan	30		
6.	divya chavan	29		
7.	chibharvi chimanpure	22		
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOODS

Rajy Shah

Sincerely,)

Proprietor

Name & Signature

(Authorised Signatory)

For SU-BHADRAA SPICES & FOODS

Rajy Shah

Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal, ,
M.P.H.Mahila College,
Malegaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Bhairvee kailas chimanpur	22		Business Administration II F.Y.
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOODS
Shah Shah
Sincerely,
Proprietor

Name & Signature
(Authorised Signatory)

For SU-BHADRAA S
Shah Shah
Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

M.P.H. College,

malegaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Rupali dhanraj Nikam	14		business Administran
2.	divyani Saluke	13		
3.	mayuri borse	9		
4.	Shital Sakat	23		
5.	Dipali Jadhav	17		
6.	pooja Chavan	30		
7.	bhairvi chimanpure	22		
8.	divya Chavahan	29		

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOO

Raju Shah

Sincerely,

Proprietor

Rupali

Name & Signature

(Authorised Signatory)

For SU-BHADRAA SPICES & FOODS

Raju Shah

Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

M.P.H.M. College,

malegoan (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Golla Vijaya	–	8355 4299 4096	Costing
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOODS

Sincerely,

Name & Signature

(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

S.P.H. Mahila College,

malejden (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully
Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Kirti Nandu Jadhav	52	32017852598	(ostin)
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-
on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of
organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOO

Sincerely,

Proprietor

Name & Signature

(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

M.P.h.Malk College,

Mauleyaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Vaishnavi Dangeh	0 6	953828568223	Cost & work AK
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Amiut Bagud.

Name & Signature

(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

M.P.H. College,

Maulepuon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Dangche Vaishnavi Jibhaa	O 6	8538 2856 Pm	Cost & Work A/c
2.	Deore madhuri Ashsh	41		Cost & work A/c
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature
(Authorised Signatory)

For SU-BHADRAA SPICES & FOODS

Shah
Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,
The Principal,
.M.P.H..... College,
malegaon. (Place)
camp.

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Priyanker Ranalka	43	739138618166	Business Administrati
2.				II , II
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

For SU-BHADRAA SPICES & FOODS

Sincerely,
Proprietor

Name & Signature
(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

M.Ph.M... College,

Malegaon. (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Priyanka Dangi	53	9108 6062 9332	Casting II & III
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.
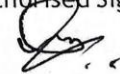
I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory)

VINAYAK TEXUi

Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

m.p.H.m College,

muleejaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Gayatri Ahire	38	455430763095	Crest & work AC II
2.				
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

PREMIUM CHICK FEEDS PVT. LTD

Name & Signature

(Authorised Signatory)

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

S.P.H.Mahila College,

Malegaon (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Gosavi Nikita	02	2095 5896 6976	Cost & Work Alc III
2.	Wagh Sujata	04	2262 1044 6104	Cost & Work Alc III
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory) Pankaj Tatas.

Proprietor

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

m.p.h.mahila College,

malegoan (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject
1.	Kirti ohewale	15	66475666 0136	cost + coork Alc III
2.	Girija khairnar	11	89804821 6780	cost + work Alc III
3.				
4.				
5.				
6.				
7.				
8.				

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

APLA MAHARSHTRA BAKERY
Muchi Corner, Shivaji Road,
Malegaon-Camp (Dist.Nasik)

Name & Signature

(Authorised Signatory)

shayyed Buteer

INTERNSHIP COMPLETION CERTIFICATE

To,

The Principal,

S.P.H........ College,

Malegaan (Place)

Subject: Internship Completion Certificate ....

Dear Madam/ Sir,

I am happy to inform you that following students of your college have successfully Completed the 'Sixty Hours Internship Programme' in this organization.

Sr. No.	Name of the student	Roll No.	Aadhar No.	Special Subject	
1.	chauhan Pooja kailas	30	6660 4452 3887	Business Administration	II -IV-
2.	Depali Jadhau	17		Business Admini	II -IV-
3.	divyani saluke	13		Business Admini	-II-III
4.	mayri borse	9		Business Admini	II-III
5.	bhariul chengpur	22		Business Admini	II- III
6.	divya chauhan	29		Business Admini	II III
7.	Shital Sakat	23		Business Admini	II-II I
8.	Pupali dhanaj	14.		Business Admini	II-II I

These students have been provided with adequate exposure and necessary hands-on training pertaining to their special subject.

I am confident that these students will perform effectively in similar type of organisations.

I wish them every success in future endeavors.

Thank you.

Sincerely,

Name & Signature

(Authorised Signatory)

For M/s. Agharkhed Clothings World

PARTNER

MAHATMA GANDHI VIDYAMANDIR'S

MAHIARATNA PUSHPATAI HIRAY

ARTS, SCINCE & COMMERCE

MAHILA MAHAVIDYALAYA

MALEGAON CAMP.

NAME:- SHITAL VALMIK SAKAT

STD :- T. Y. BCOM.

[INTERNSHIP PROGRAM PROPOSAL]

ACADAMIC YEAY : 2021-2022

ROLL NO:- (28)

SUB:- BUSINESS ADMINISTRATION

GUIDED BY : PROF: DEEPALI CHANDRAMORE

PROF: V.D. RAMAVAT

PROF: S.L. YENNAKIAR.

Page No.

Date

ABOUT THE FIRM

FIRM NAME :-
SHREE KAKAJI MASALE

NAME OF OWNER:
DHARMENDRA SURESHCHADRA
SHAH.

ADDRESS : -
960 LODHA BHAVAN, MALEGAON
CAMP- 423203

EMAIL :
kakajimasale @gmail. com.

Date

PROCESS OF PRODUCTION

* Purchasing RAW material, spices from another firm.

* Shorting by Worker's of Raw material.

* Rosting of dry material

* Griding of spices by Machines.

Date

INTRODUCTION ABOUT FIRM.

KAKAJI MASALE established on 1883 by dharamendra Sureshchandra shah. KAKAJI MASALA is an Spices & Dry - Fruits production & Selling firm in Malegaon.

KAKAJI MASALE is most popular firm in Malegaon. This firm Selling Different types of MASALE & Dry Fruits. In this Firm there are 15 Men & 1 Women are Worker's are Working under the guidance of Managers.

Turnover of these firm 5 lakh.

Mahatma Gandhi Vidhyamandir's
MahilaRatna Pushpatai Hiray Arts, Science
and Commerce Mahila Mahavidyalaya, Camp
Road Malegaon, Nasbik (Pune University)

STD = T.Y. Bcom - 2019 Credit pattern sem VI

Internship program Report.

Subject - Business Administration II, III

Roll No - 43

Name of Guide - 1) Deepali Chandmore

2) D.R. Vaijayanti Ramawat

3) S.L. Yennawar.

Presented by - Ranalkar Priyanka Rajendra.

Name of the Organization

Name of the Institute – Shree Suresh
Masale

Address – 960 Lodha Bhavan, Malegaon
satana Road, Maharashtra 423203

Contact Number – 7277331111

Email Id – kakajimasale@yahoo.com

Name of the owner – Nilesh shaha

List of Conteant learn.

- financing planning
- Need of financing
- Ability to Resarch.
- Ability to mang time, projects and resources.
- Bousting Confidence.
- Organization skills.
- Customer service.

1. financing planning - for start business or begain t business financing planning is very essential. and how to use money or resorches planning is need to doen.

2. Ability to Resarch - Wherever we are working or doing any business or raning ang Companys. we should have a ability to resarch. when we wi sarch things or observemt then our work will in prograss.

3. Bousting Confidence - Administration skills gives u Confidence to do work in right manners having hea realoshinship with our Colleuges. and for talk to th people we have to have Confidence so this progra Bolst my Confidence.

4. Organization skills - I learn How to orgaize thing in right manner. How things and helpers should do their work. propsely.