3.7.1.1: Total number of Collaborative activities per year for research/ faculty exchange/ student exchange/ internship/ on –the-job training/ project work

2018-19

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Chaitanya Bharathi Institute of Technology
(Autonomous)
Gandipet, Hyderabad-500 075.

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Principal
Chaitanya Bharathi Institute of Technology
(Autonomous)
Gandipet, Hyderabad-500 075.

Gmail

Apoorva ventra <apoorva1196@gmail.com>

Fwd: Servicenow: Shortlisted students for internship

1 message

Sat, Dec 15, 2018 at 10:01 AM

Shravya Sheela <shravyasheela97@gmail.com>
To: Apoorva ventra <apoorva1196@gmail.com>

---------- Forwarded message ---------
From: Nln Reddy <nlnreddypo@gmail.com>
Date: Sat 15 Dec. 2018, 10:01 AM
Subject: Fwd: Servicenow: Shortlisted students for internship
To: <cbit.sreekarasg@gmail.com>, <katapallyakhila@gmail.com>, Lokesh Kota <klkb1998@gmail.com>, <mnrkumarmalladi@gmail.com>, <mounica.vaddepally@gmail.com>, <ronithraj.k@gmail.com>, <sahitya.satrasala3@gmail.com>, <srikeshpulluri11@gmail.com>, <srisowbhagya3@gmail.com>, <varshikchebrolu@gmail.com>, <vijaytirumalasetty97@gmail.com>, akhila mora <akhila.mora1315@gmail.com>, anil krishna <anilkrishna11@gmail.com>, Ankitha P <ankithaias@gmail.com>, Asra Naseem <asranaseem98@gmail.com>, BhargavReddy Muthukuru <bhargavreddymuthukuru@gmail.com>, bhavesh raja <rajabhavesh@gmail.com>, Divya k <kdivyarsha4@gmail.com>, Gopala Kala <gopalakrishna.kala@gmail.com>, Harsha Vardhanrao <harshavardhanrao45@gmail.com>, Jagannath Saragadam <jagannathsrs@gmail.com>, Jaswanth Lella <jaswanthlnn@gmail.com>, Krishna Kaundinya Desaraju <contact.kk1997@gmail.com>, mallikarjuna reddy <mallikarjunareddy2610@gmail.com>, Mani Deepika <manidpka@gmail.com>, Meera Prasanna Ayyagari <ayyagarimeeraprasanna@gmail.com>, naveen vanamala <naveenv.vanamala@gmail.com>, Nihitha Veeramachaneni <v.nihitha@gmail.com>, Nitin Reddy <nitinreddy1998@gmail.com>, Praveka Surapaneni <praveka@gmail.com>, Rahul Konakanchi <rahulkonakanchi97@gmail.com>, RAJEEV KUMAR <rajeevroxx4@gmail.com>, Rashmi Kapoor <rashmikapoor1998@gmail.com>, Rishi RTM <rishimadduri@gmail.com>, sai akhil <rayapudisaiakhil@gmail.com>, Sai Bhavana <bhavanayvs@gmail.com>, Saiteja Bandari <saitejabandari27@gmail.com>, Shashidhar Mamidipelli <mshashidhar1@gmail.com>, Shravya Sheela <shravyasheela97@gmail.com>, Shreyas Amin <shreyasravishamin@gmail.com>, Siddharth Gupta <siddharthguptasg97@gmail.com>, <aec@cbit.ac.in>, <hod_biotech@cbit.ac.in>, <hod_chem@cbit.ac.in>, <hod_cse@cbit.ac.in>, <hod_eee@cbit.ac.in>, <hod_it@cbit.ac.in>, ECE HEAD <hod_ece@cbit.ac.in>, Hod Lib Dr. Srikanth <librarian@cbit.ac.in>, hod_civil <hod_civil@cbit.ac.in>, Mechanical HEAD <hod_mech@cbit.ac.in>

---------- Forwarded message ---------
From: **Sai Ram Neelam** <sairam.neelam@servicenow.com>
Date: Fri, Dec 14, 2018 at 6:30 PM
Subject: Servicenow: Shortlisted students for internship
To: nlnreddy.po@gmail.com <nlnreddy.po@gmail.com>
Cc: Pavan Alamanda <pavan.alamanda@servicenow.com>

Hi Team,

As discussed, we are proving 6 months internship opportunity with Servicenow for below 5 students (3 from Hackathon & 2 earlier campus selects).

Internship time frame will be from 7th Jan 2019 to 30th June 2019.

Hackathon Students:

[redacted] Sai Nikhita	7207551194	sainikhitanayani@gmail.com
Kunta Vanita	7673993258	vanithakunta2406@gmail.com

Campus Selects:

[redacted]	B.Tech	Computer Science	7995949361	apoorva1196@gmail.com
[redacted]	B.Tech	Computer Science	8125666112	siddharthguptasg97@gmail.com

Students will be received intern offer by end of Dec 2018. Request you to cascade this information to the students and make them available in mentioned time frame.

For any additional information kindly reach out to Ram – 9966995656 / Pavan A – 9886320444.

Ram Neelam| Staffing Partner, India

ServiceNow | Work at Lightspeed

Mobile: +91-9966995656 I www.servicenow.com

--

With Best Regards,

Dr. NLN REDDY,
TPO., CBIT.
98494 66587

IT-1(414) Bhavitha.M(7842539567)
Suseela(7995267170)

merilytics

December 19, 2018

To,
Ms. Bhavitha Maile,
Hyderabad.

Dear Bhavitha,

Congratulations!!!

With reference to your interview conducted by us at Chaitanya Bharathi Institute of Technology, Hyderabad, we are pleased to inform you that your internship request at Meritus Intelytics Private Limited ("Merilytics") has been accepted.

We would like you to start your internship with us on **24th Dec 2018** and during this period, you will be paid a stipend of Rs. 20,000.00 per month, less all applicable taxes. Also, please note that, as a "temporary employee", you will not be eligible for any company benefits and other perks. You will be allocated a fixed number of leaves per month (apart from the declared holidays), exceeding which will result in loss of pay. You will be based out of our Hyderabad offices.

Your internship is expected to **last for 6 months from the start date**. However, you have the right to terminate internship for any reason, or no reason, at any time by giving 14 days' notice. Merilytics also reserves the right to terminate your internship by giving 7 days' notice, which is not applicable if reasons are related to performance and fraud issues. The terms of internship are not subject to change or modification of any kind except if in writing and signed by you and the CEO of Merilytics.

During your internship, you may have access to confidential and sensitive information belonging to the Company. By accepting this internship offer, you acknowledge that you will keep all such information strictly confidential and refrain from disclosing it to anybody outside the Company, including friends and family members. In addition, you agree that, upon completion of your internship, you will immediately return all the Company assets as required. Also, you agree that throughout your internship, you will adhere to the Company policies and procedures governing the conduct of business and employees. Non-compliance on any of the above clauses will result in disciplinary action, up to and including termination of the internship.

Once again, we are glad to have you onboard for rewarding internship experience at Merilytics. We look forward to working with you soon.

Meritus Intelytics Pvt. Ltd., 2nd floor, Gutenberg IT Park, Kondapur,
Hyderabad, Telangana 500084, India; Ph: +91 8179935387; Email: careers@merilytics.com

If you have any questions regarding the above, please do not hesitate to write to us at careers@merilytics.com

Sincerely,

For Meritus Intelytics Private Limited

Authorized Signatory

(Paavan Choudary)

Cognizant

04-Dec-2018

Dear Hari Priyanka Sunkari Anusuya,
B.Tech/B.E., Information Technology
Chaitanya Bharathi Institute of Technology

Candidate ID – 12485546

In continuation to our discussions, we are pleased to offer you the role of **Programmer Analyst Trainee** in **Cognizant Technology Solutions India Private Limited ("Cognizant")**.

During your probation period of 12 months, which includes your training program, you are entitled to an Annual Total Remuneration (ATR) of **Rs.338,005/-**. This includes an annual incentive indication of **Rs.20,000/-** as well as Cognizant's contribution of **Rs.21,005/-** towards benefits such as Medical, Accident, Life Insurance and Gratuity. The break up is presented in **Annexure A**

On successful completion of the probation period, clearing the required training assessments and subject to you being part of a delivery project, your annual Total Remuneration (ATR) would stand revised to **Rs.383,755/-**. This includes an annual incentive indication of **Rs.20,000/-** as well as Cognizant's contribution of **Rs.21,755/-** towards benefits such as Medical, Accident, Life Insurance and Gratuity.

Your appointment will be governed by the terms and conditions of employment presented in **Annexure B**. You will also be governed by the other rules, regulations and practices in vogue and those that may change from time to time. Your compensation is highly confidential and if the need arises, you may discuss it only with your Manager.

Cognizant is keen that there is a secure environment for clients and internally too. You are required to be registered with the National Skills Registry (NSR) and provide the ITPIN while joining the organization. Please refer Annexure B for more details.

Please note
- This appointment is subject to satisfactory professional reference checks and you securing a minimum of 60% aggregate (all subjects taken into consideration) with no standing arrears in your Graduation/Post-Graduation.
- Prior to commencing employment with Cognizant you must provide Cognizant with evidence of your right to work in India and other such documents as Cognizant may request.

We look forward to you joining us. Should you have any further questions or clarifications, please log into https://campus2cognizant.cognizant.com

Yours sincerely,
For Cognizant Technology Solutions India Pvt. Ltd.,

Suresh Bethavandu
Global Head-Talent Acquisition
I have read the offer, understood and accept the above mentioned terms and conditions.

Signature : **Date:**

S.A. Sudhakar
9177096082

S.A. Hari Priyanka
8965023460

Hello JyothsnaJyothsna,

Your first day at Wells Fargo isn't far away. We are equally excited to meet you!

1. Your date of joining: 28th Jan,2019.
2. Reporting location: **HyderabadHyderabad.**
3. Reporting time: 8.30 AM

Please be prepared to join us on 28 Jan, 2019. We will get back to you shortly with the offer letter and on-boarding details.

Note: **If you don't have a PAN card, please apply for one immediately as it is mandatory for stipend payroll processing.**

Wishing you a Happy New Year!

Thanks & Regards

Pravin Kumar. H

EVERYDAY MADE EASIER™

NCR Corporation India Pvt. Ltd.
Raheja Mindspace IT Park,
Building 12C, 8th Floor,
Survey No. 64, APIIC Software Layout,
HITEC City, Madhapur, Hyderabad,
Telangana 500081
Tel.: +91 - 40 - 6799 3388

PERSONAL AND CONFIDENTIAL

11-Dec-2018

Keerthana Reddy Varakala
H.No-28-1023, Housing Board, Vidya nagar colony,Miryalaguda
Nalgonda, 508207

Dear Keerthana Reddy,

elcome to NCR, a global technology company that runs the everyday transactions that make our life easier.

With a presence in 180 countries, our people offer a broad perspective and range of skills that enable our customers to making every customer interaction with their business an exceptional experience.

We are pleased to present you with this offer of employment at NCR. I am certain you will be a key contributor to this organization. On behalf of my team, we look forward to you joining us.

Employer (Legal Entity):

NCR Corporation India PVT. LTD. (the 'Company')

Position:

SW Engineer

Job Grade:

s position is a Grade 09

Reporting To:

Srinivas Maddipatla, Business Operations Supv

Business Unit:

CTO

Location:

HYDERABAD - OFFICE

WELLS FARGO

Wells Fargo EGS (India) Private Limited (formerly known as Wells Fargo India Solutions Private Limited)
Wells Fargo Centre
Embassy Tech Village
Deverabeesanahalli, Outer Ring Road
Varthur Hobli, Bengaluru, India 560103
wellsfargo.com

OFFER OF EMPLOYMENT

Dear Challa Pragna.

We are pleased to offer you a position at **Wells Fargo India Solutions Private Limited (Wells Fargo)**, and your appointment shall be effective from the Date of Joining as mentioned below, on the following terms and conditions:

- **Designation:** You will be designated as **Analyst. Notwithstanding anything herein**, this offer is conditional on Wells Fargo receiving a satisfactory reference and background check on you. On your first day of employment **July 1, 2019 (DOJ)** you will need to report before 8:30 a.m. at Wells Fargo India Solutions Private Limited.

- **Training Period:** The first 2 Months would be a period of induction and extensive training ("Training Period"), during which Wells Fargo would take care of boarding and lodging, and transport to office and back, and you would be paid a stipend of INR 20000 (Rupees Twenty Thousand Only) per month.

- **Compensation:** Your total annual fixed compensation (inclusive of contributions to be made towards various social security schemes such as Wells Fargo's contribution to Provident Fund), would be **INR 550,000/-(Rupees Five Lakh Fifty Thousand Only).** Please note that tax will be deducted at source from your gross compensation above in compliance with prevailing tax regulations. The detailed break-up of the compensation offered to you is outlined in Annexure 'A' to this letter.

- **Place of Work:** You will be initially based at the Wells Fargo office in Hyderabad Or Bangalore or Chennai. However, Wells Fargo reserves the right to transfer you from one office to another, at its discretion during the term of your service. You may be required to work from different offices and in different shifts from time to time. Wells Fargo further reserves the right to change your shift timings, job title, designation, reporting lines and reporting manager, in line with applicable laws, during the term of your service.

- **Duties:** You will perform all acts, duties and obligations and comply with such instructions as may be specified by Wells Fargo and which are reasonably consistent with your job title and profile. Wells Fargo may require you to undertake the duties of another position, either in addition to or instead of the above duties, it being understood that you will not be required to perform duties, which are not reasonably within your capabilities. Wells Fargo may also require you (as part of your duties of employment) to perform duties or services not only for Wells Fargo but also for any Affiliate/Associated Company where such duties or services are of a similar status to or consistent with your position with Wells Fargo.

- **Confidential Information and Inventions:** As an employee of Wells Fargo, you will have access to Wells Fargo's confidential information and you may, during the course of your employment, develop certain

January 8, 2019

Chede, Sai Spandana
Hno:1-8-700/40
Hyderabad, Andhra Pradesh 500044

Dear Sai Spandana,

Your Internship by J.P. Morgan

Congratulations on joining the J.P. Morgan family. We are pleased to confirm your internship with J.P. Morgan Services India Private Limited (the "Company").

You will find your personal internship terms outlined in Appendix A with general internship terms and conditions in Appendix B. Please note these terms and conditions supersede any verbal discussions you may have previously had with any JPMorgan Chase employee with regards to your internship arrangements.

A number of important policies will apply to your internship with the Company, including the Personal Account Dealing Policy and the Code of Conduct. We provide more information about these policies in Appendix C and it is essential that you carefully read and understand their requirements. By signing this letter, you confirm that you have read, understood and agree to be bound by these policies. In addition, you will be required to abide by all other Company policies and regulations (including JPMorgan Chase group of companies (the "Group") policies) and with applicable law.

Should you have queries in relation to your internship terms, please contact Paramveer Narang at + 91 8067907233. For queries about your benefits or Company policies, please contact our accessHR hotline at 0008004405210 (local toll free) or +1 212-552-5100 (international).

Please be reminded your internship terms should be treated with the strictest confidence. To accept this offer of internship, please click on the 'Accept' button at the bottom of this page on or before January 15, 2019.

We are excited to welcome you to our Company and take this opportunity to wish you every success in taking this next step of your career with us.

*This is a computer generated communication and does not have a signature.

KARVY Computershare

Private &Confidential

Ref No. 216566

Date: 15 November 2018

Mr. Abhishek Mupidi,
2-2-1136/1/a, New Nallakunta
Ramalayam Lane

Hyderabad - 500044

Dear Abhishek Mupidi,

Subject : Offer Cum Appointment Letter

Further to your application and the subsequent discussion with us, we are pleased to offer you a career in **Karvy Computershare (P) Limited**, as per the terms and conditions mentioned herein:

1. Date of joining, posting & location

You will join us on **7 January 2019** in our **Kcpl** Division at **Hyderabad.** Your title will be, **Executive Trainee** in Grade **S0 (Executive Trainee).** The Management reserves the right to transfer you on any assignment in any unit / department / associate concern of the Company anywhere in India or Abroad, as it may consider necessary, in its absolute discretion, from time to time, subject to the provision that your remuneration and other facilities will not be adversely affected.

2. Compensation

You shall be entitled to an all inclusive annual gross compensation of **Rs.3,50,000/- (Rupees Three Lakhs Fifty Thousand only).** A detailed break-up of your compensation structure is given in the Annexure (I) to this letter. The Compensation package shall be governed by the Policies and Guidelines of the Company presently applicable and as may be modified from time to time.

Further you are required to strictly maintain the secrecy and ensure that you do not divulge or communicate in any manner, any information regarding your remuneration or terms of employment to any other employee of the Company or other public at large. If found revealing any of the above information, strict disciplinary action shall be taken against you including but not limited to termination of your employment without any notice.

3. Probation Period

You will be on probation for a period of **12** months from the date of your joining. The probation may be extended for a further period or periods as determined by the Management and you will continue to be on probation until an order of confirmation in writing is issued, notwithstanding the expiry of the probation period.

On satisfactory completion of the probation period and on being found suitable in the post to which you have been appointed by this letter, you will be determined and fixed in appropriate manner. The management may place you in any scale of pay consisting various elements or allowances or consolidated salary from time to time at their discretion fixing you at the appropriate stage as they consider it proper.

4. Notice period

During Probation Period

Your services are liable to be terminated by the company without assigning any reason by giving **60 (Sixty)** days notice period or payment of gross monthly salary in lieu thereof on either side. However, in the event of your resignation, you shall have to serve a notice for **60 (Sixty)** days,but the Company in its sole discretion shall have an option to accept the same and relieve you prior to completion of stipulated notice period of 60 days,without any pay in lieu of notice period.

rnship Initiation Process at Byju's The Learning App

Gmail

Internship Initiation Process at Byju's The Learning App

2 messages

Shefali Singh <shefali.singh+14208@byjus.com>
Reply-To: shefali.singh+14208@byjus.com
To: adityakante@gmail.com

Dear Aditya Kante,

Congratulations!! We are thrilled to inform that you have been selected at **BYJU'S – The Learning App** through our campus connect program and you will begin in the position of **Business Development Intern**.

BYJU'S is one of the world's largest edu-tech companies and India's most-loved education app that offers students a platform to explore their curious minds fuelled by adaptive, engaging and effective learning programs. BYJU'S has been at the forefront of creating unique learning experiences for students across grades and help children fall in love with learning. Launched in 2015, BYJU'S is the most preferred education app for students across age groups.

Today, BYJU'S has over 12 million downloads, 700,000 annual paid subscriptions and sees an addition of 40,000 students every month. With an average time of 51 minutes being spent by a student on the app every day from 1700+ cities, BYJU'S – The Learning App is making learning enjoyable and effective. Also, the annual renewal rates of 90% is a testament of the fact that the app is helping students learn better.

BYJU'S is backed by strong partners like the Chan-Zuckerberg Initiative, World Bank's investment arm – International Finance Corporation (IFC),Verlinvest, Tencent, Aarin, Sequoia Capital, Sofina, TimesInternet and Lightspeed ventures. BYJU'S is also the largest funded Ed-tech startup in India and aims to become the largest education company in the world.

At BYJU'S, we are driven by the motto to encourage students to learn on their own and keep their child-like curiosity alive. So get ready to be a part of the growing family at BYJU'S and be a ***BYJUite*** officially. We hope your journey with us takes you to greater heights creating the best of memories and milestones along the way.

Visit https://youtu.be/2XeGf5RHypQ for a better insight into the job.

Please make a note of below details to smoothen your onboarding with us:

Date of Joining: 02/11/2019

Role Location: Hyderabad

Intership Stipend - 25000/Month

Further details:

2/5/2019, 10:54

rnship Initiation Process at Byju's The Learning App

Gmail

Internship Initiation Process at Byju's The Learning App

2 messages

Shefali Singh <shefali.singh+14208@byjus.com>
Reply-To: shefali.singh+14208@byjus.com
To: adityakante@gmail.com

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Visit https://youtu.be/2XeGf5RHypQ for a better insight into the job.

Please make a note of below details to smoothen your onboarding with us:

Date of Joining: 02/11/2019

Role Location: Hyderabad

Internship Stipend - 25000/Month

Further details:

2/5/2019, 10:54

Ref No: HROPS/IL/284

Date : January 04,2019

Dear Chandrahas Reddy Mandapati,
CBIT, Hyderabad

Internship Letter

We are happy to confirm your request for Internship with Delhivery Pvt Ltd, subject to the following:

1. Your training will be for a period of 6 Months ' starting 21-Jan-19.
2. You will be assigned to the Technology department as Management Trainee based in Hyderabad under the supervision of Karthik Jayanthi.
3. You will be provided with a stipend not exceeding INR 25000 per month, towards meeting your daily expenses, through your bank account, during the subsequent calendar month.
4. You are expected to abide by the company's guidelines on code of conduct and expected behaviour.
5. You shall, upon completion of your internship, also return to the company, any assets, documents etc. in your possession
6. You shall not use any proprietary information, gathered as part of the internship with Delhivery Pvt Ltd, without prior written consent of the undersigned.
7. This Internship can be terminated by either party by providing a notice period of 7 days.
8. This internship does not guarantee any employment with Delhivery Pvt Ltd, or its associates.

We trust that you will find this a challenging and exciting opportunity to learn from the Delhivery team.
Please return a signed copy of this letter to acknowledge your acceptance to the above.

Yours sincerely,

Suraju Dutta
Managing Director

I,Chandrahas Reddy Mandapati hereby accept tl
above mentioned terms and conditions
and further agree to abide by the
rules and regulations of the Company.

Signature : .....
Date : .....

Version No - 1

Version Date - 03-Oct-2017

UANGTEMAN

Appointment Letter

Private & Confidential

31 December 2018

Mr. Koushik Gadapale,
Hyderabad.

Dear Mr.Koushik,

With reference to your application and subsequent interview with us, we are pleased to appoint you as **Data Scientist Intern** in **Uangteman Technologies Private Limited., Hyderabad** on the following terms and conditions.

Date of Joining: Your joining date will be on **7th January 2019**.

End date: **7th April 2019.** On submission of project report you will be acquiring a certificate from company.

Salary: As an internship of 3 months, stipend would be **Rs. 8000/- PM (Rupees Five Thousand Only)**.

Place/Transfer: Your present place of work will be at **Uangteman Technologies Private Limited., I Labs, Hyderabad Technology Park, Level 2, Oval Building, Plot No. 18, In orbit Mall Road, Hyderabad**, but during the course of the service, you shall be liable to be posted / transferred anywhere to serve any of the Company's Projects or any other establishment in India or outside, at the sole discretion of the Management.

With best wishes,

For UangtemanTechnologies Pvt. Ltd.

Vijay Kumar Donthineni

AVP, Delivery Manager

Accepted and Agreed

Koushik Gadapale

Dated: 4-01-2019

Uangteman Technologies Pvt. Ltd.
D.No.101, Plot No.156, 157, SYNO-3, Saranya Apts,
Behind Turbo Machinery, Bachupally, Hyderabad
Telangana-500092
contact@uangteman.com | www.uangteman.com

KARVY Computershare

Private &Confidential

Ref No. 216506

Date: 14 November 2018

Mr. Pavan Sai Cherukuri,
8-4-103, Venugopal Nagar 2, Khanapuram Haveli

Khammam - 507002

Dear Pavan Sai Cherukuri,

Subject : Offer Cum Appointment Letter

Further to your application and the subsequent discussion with us, we are pleased to offer you a career in **Karvy Computershare (P) Limited**, as per the terms and conditions mentioned herein:

1. Date of joining, posting & location

You will join us on **7 January 2019** in our **Kcpl** Division at **Hyderabad.** Your title will be, **Executive Trainee** in Grade **S0 (Executive Trainee).** The Management reserves the right to transfer you on any assignment in any unit / department / associate concern of the Company anywhere in India or Abroad, as it may consider necessary, in its absolute discretion, from time to time, subject to the provision that your remuneration and other facilities will not be adversely affected.

2. Compensation

You shall be entitled to an all inclusive annual gross compensation of **Rs.3,50,000/- (Rupees Three Lakhs Fifty Thousand only).** A detailed break-up of your compensation structure is given in the Annexure (I) to this letter. The Compensation package shall be governed by the Policies and Guidelines of the Company presently applicable and as may be modified from time to time.

Further you are required to strictly maintain the secrecy and ensure that you do not divulge or communicate in any manner, any information regarding your remuneration or terms of employment to any other employee of the Company or other public at large. If found revealing any of the above information, strict disciplinary action shall be taken against you including but not limited to termination of your employment without any notice.

3. Probation Period

You will be on probation for a period of 12 months from the date of your joining. The probation may be extended for a further period or periods as determined by the Management and you will continue to be on probation until an order of confirmation in writing is issued, notwithstanding the expiry of the probation period.

On satisfactory completion of the probation period and on being found suitable in the post to which you have been appointed by this letter, you will be determined and fixed in appropriate manner. The management may place you in any scale of pay consisting various elements or allowances or consolidated salary from time to time at their discretion fixing you at the appropriate stage as they consider it proper.

4. Notice period

During Probation Period

Your services are liable to be terminated by the company without assigning any reason by giving **60 (Sixty)** days notice period or payment of gross monthly salary in lieu thereof on either side. However, in the event of your resignation, you shall have to serve a notice for 60 **(Sixty)** days,but the Company in its sole discretion shall have an option to accept the same and relieve you prior to completion of stipulated notice period of 60 days,without any pay in lieu of notice period.

Haier

GE APPLIANCES
a Haier company

6th Floor, Unit 2,
Salarpuria Sattva Knowledge City,
Survey No.83/1, Plot No.2, Inorbit Mall Road,
Hyderabad-500081, T +91 40 4000 1818
Email: ~ApplianceIndiaHR@geappliance.com
Web: www.geappliances.com

17-Oct-2018

Jagannath Saragadam
Plot No 134-B, Flat No 3B,
KK Mansion, Lane 18,
SR Nagar, Hyderabad -38

Dear Jagannath,

Congratulations!

You have been selected as an "IT Intern" with GE Appliances, a Haier Company. Your assignment will begin on January 7, 2019 and will end in a period of 6 months.

Subject to the compliance with terms enclosed as Annexure 1, during the above period you will be paid a stipend amount of **INR 20000 (Rupees Twenty Thousand Only) per month**. This offer is subject to your joining us on the mentioned date and time. Annexure 2 and 3 provide helpful information. You hereby consent that your engagement will be terminated with an immediate effect if the Compliance terms and conditions stated in Annexure 1 are not complied.

Please note that your letter of employment will be held void in case of performance issues during the internship period.

This offer is valid until 7 days from the date of this letter. Look forward to your acceptance.

Yours Sincerely,
For Wonder Global (India) Technology Center Private Limited

V. Chandramouli

Chandramouli Vijjhala
CIO, India
Signed on 17th October 2018

Enclosure:

Annexure 1 – Compliance Terms and Conditions
Annexure 2 – Reporting Time /Joining Formalities/Facilities
Annexure 3 – Travel Reimbursement

J.P.Morgan

January 9, 2019

panigrahi, siddharth
H no: 18-10-64 sonic apartments, backside abood jaidi function hall ,barkas
hyderabad, Andhra Pradesh 500005

Dear siddharth,

Your Internship by J.P. Morgan

Congratulations on joining the J.P. Morgan family. We are pleased to confirm your internship with J.P. Morgan Services India Private Limited (the "Company").

You will find your personal internship terms outlined in Appendix A with general internship terms and conditions in Appendix B. Please note these terms and conditions supersede any verbal discussions you may have previously had with any JPMorgan Chase employee with regards to your internship arrangements.

A number of important policies will apply to your internship with the Company, including the Personal Account Dealing Policy and the Code of Conduct. We provide more information about these policies in Appendix C and it is essential that you carefully read and understand their requirements. By signing this letter, you confirm that you have read, understood and agree to be bound by these policies. In addition, you will be required to abide by all other Company policies and regulations (including JPMorgan Chase group of companies (the "Group") policies) and with applicable law.

Should you have queries in relation to your internship terms, please contact Paramveer Narang at + 91 8067907233. For queries about your benefits or Company policies, please contact our accessHR hotline at 0008004405210 (local toll free) or +1 212-552-5100 (international).

Please be reminded your internship terms should be treated with the strictest confidence. To accept this offer of internship, please click on the 'Accept' button at the bottom of this page on or before January 15, 2019.

We are excited to welcome you to our Company and take this opportunity to wish you every success in taking this next step of your career with us.

*This is a computer generated communication and does not have a signature.

KARVY Computershare

Private &Confidential

Ref No. 216540

Date: 15 November 2018

Ms. Soumith Peketi, (7036334333)
2-33-4, Peketi, Vari Street
Sri Nagar

Kakinada - 533003

S/o P. Soma Raju
9059944099.

Dear Soumith Peketi,

Subject : Offer Cum Appointment Letter

Further to your application and the subsequent discussion with us, we are pleased to offer you a career in **Karvy Computershare (P) Limited**, as per the terms and conditions mentioned herein:

1. Date of joining, posting & location

You will join us on **1 January 2019** in our **Kcpl** Division at **Hyderabad**. Your title will be, **Executive Trainee** in Grade **S0 (Executive Trainee).** The Management reserves the right to transfer you on any assignment in any unit / department / associate concern of the Company anywhere in India or Abroad, as it may consider necessary, in its absolute discretion, from time to time, subject to the provision that your remuneration and other facilities will not be adversely affected.

2. Compensation

You shall be entitled to an all inclusive annual gross compensation of **Rs.3,50,000/- (Rupees Three Lakhs Fifty Thousand only).** A detailed break-up of your compensation structure is given in the Annexure (I) to this letter. The Compensation package shall be governed by the Policies and Guidelines of the Company presently applicable and as may be modified from time to time.

Further you are required to strictly maintain the secrecy and ensure that you do not divulge or communicate in any manner, any information regarding your remuneration or terms of employment to any other employee of the Company or other public at large. If found revealing any of the above information, strict disciplinary action shall be taken against you including but not limited to termination of your employment without any notice.

3. Probation Period

You will be on probation for a period of **12** months from the date of your joining. The probation may be extended for a further period or periods as determined by the Management and you will continue to be on probation until an order of confirmation in writing is issued, notwithstanding the expiry of the probation period.

On satisfactory completion of the probation period and on being found suitable in the post to which you have been appointed by this letter, you will be determined and fixed in appropriate manner. The management may place you in any scale of pay consisting various elements or allowances or consolidated salary from time to time at their discretion fixing you at the appropriate stage as they consider it proper.

4. Notice period

During Probation Period

Your services are liable to be terminated by the company without assigning any reason by giving **60 (Sixty)** days notice period or payment of gross monthly salary in lieu thereof on either side. However, in the event of your resignation, you shall have to serve a notice for **60 (Sixty)** days,but the Company in its sole discretion shall have an option to accept the same and relieve you prior to completion of stipulated notice period of 60 days,without any pay in lieu of notice period.

Cognizant

04-Dec-2018

Dear Kiran Kumar Chirra,
B.Tech/B.E., Information Technology
Chaitanya Bharathi Institute of Technology

Candidate ID – 12485512

In continuation to our discussions, we are pleased to offer you the role of **Programmer Analyst Trainee** in **Cognizant Technology Solutions India Private Limited ("Cognizant")**.

During your probation period of 12 months, which includes your training program, you are entitled to an Annual Total Remuneration (ATR) of **Rs.338,005/-**. This includes an annual incentive indication of **Rs.20,000/-** as well as Cognizant's contribution of **Rs.21,005/-** towards benefits such as Medical, Accident, Life Insurance and Gratuity. The break up is presented in **Annexure A**.

On successful completion of the probation period, clearing the required training assessments and subject to you being part of a delivery project, your annual Total Remuneration (ATR) would stand revised to **Rs.383,755/-**. This includes an annual incentive indication of **Rs.20,000/-** as well as Cognizant's contribution of **Rs. 21,755/-** towards benefits such as Medical, Accident, Life Insurance and Gratuity.

Your appointment will be governed by the terms and conditions of employment presented in **Annexure B**. You will also be governed by the other rules, regulations and practices in vogue and those that may change from time to time. Your compensation is highly confidential and if the need arises, you may discuss it only with your Manager.

Cognizant is keen that there is a secure environment for clients and internally too. You are required to be registered with the National Skills Registry (NSR) and provide the ITPIN while joining the organization. Please refer Annexure B for more details.

Please note
- This appointment is subject to satisfactory professional reference checks and you securing a minimum of 60% aggregate (all subjects taken into consideration) with no standing arrears in your Graduation/Post-Graduation.
- Prior to commencing employment with Cognizant you must provide Cognizant with evidence of your right to work in India and other such documents as Cognizant may request.

We look forward to you joining us. Should you have any further questions or clarifications, please log into https://campus2cognizant.cognizant.com

Yours sincerely,
For Cognizant Technology Solutions India Pvt. Ltd.,

Suresh Bethavandu
Global Head-Talent Acquisition
I have read the offer, understood and accept the above mentioned terms and conditions.

Signature : **Date:**

KARVY Computershare

Private &Confidential

Ref No. 216546

Date: 15 November 2018

Mr. Venkatadasu K,
4-33, Dagadapally,
Ammayapally,

Mahabubnagar - 509104

Dear Venkatadasu K,

Subject : Offer Cum Appointment Letter

Further to your application and the subsequent discussion with us, we are pleased to offer you a career in **Karvy Computershare (P) Limited**, as per the terms and conditions mentioned herein:

1. Date of joining, posting & location

You will join us on **7 January 2019** in our **Kcpl** Division at **Hyderabad.** Your title will be, **Executive Trainee** in Grade **S0 (Executive Trainee).** The Management reserves the right to transfer you on any assignment in any unit / department / associate concern of the Company anywhere in India or Abroad, as it may consider necessary, in its absolute discretion, from time to time, subject to the provision that your remuneration and other facilities will not be adversely affected.

2. Compensation

You shall be entitled to an all inclusive annual gross compensation of **Rs.3,50,000/- (Rupees Three Lakhs Fifty Thousand only).** A detailed break-up of your compensation structure is given in the Annexure (I) to this letter. The Compensation package shall be governed by the Policies and Guidelines of the Company presently applicable and as may be modified from time to time.

Further you are required to strictly maintain the secrecy and ensure that you do not divulge or communicate in any manner, any information regarding your remuneration or terms of employment to any other employee of the Company or other public at large. If found revealing any of the above information, strict disciplinary action shall be taken against you including but not limited to termination of your employment without any notice.

3. Probation Period

You will be on probation for a period of **12** months from the date of your joining. The probation may be extended for a further period or periods as determined by the Management and you will continue to be on probation until an order of confirmation in writing is issued, notwithstanding the expiry of the probation period.

On satisfactory completion of the probation period and on being found suitable in the post to which you have been appointed by this letter, you will be determined and fixed in appropriate manner. The management may place you in any scale of pay consisting various elements or allowances or consolidated salary from time to time at their discretion fixing you at the appropriate stage as they consider it proper.

4. Notice period

During Probation Period

Your services are liable to be terminated by the company without assigning any reason by giving **60 (Sixty)** days notice period or payment of gross monthly salary in lieu thereof on either side. However, in the event of your resignation, you shall have to serve a notice for **60 (Sixty)** days,but the Company in its sole discretion shall have an option to accept the same and relieve you prior to completion of stipulated notice period of 60 days,without any pay in lieu of notice period.

160115737312
Nitya Ingale

KARVY
Computershare

Ref No. 216503

Private &Confidential

Date: 14 November 2018

Lata Ingale
9703153131

Ms. Nitya I,
4-3-59, 2nd Floor, Sultan Bazar, Koti

Hyderabad - 500095

Dear Nitya I,

Subject : Offer Cum Appointment Letter

Further to your application and the subsequent discussion with us, we are pleased to offer you a career in **Karvy Computershare (P) Limited**, as per the terms and conditions mentioned herein:

1. Date of joining, posting & location

You will join us on **7 January 2019** in our Kcpl Division at **Hyderabad.** Your title will be, **Executive Trainee** in Grade **S0 (Executive Trainee).** The Management reserves the right to transfer you on any assignment in any unit / department / associate concern of the Company anywhere in India or Abroad, as it may consider necessary, in its absolute discretion, from time to time, subject to the provision that your remuneration and other facilities will not be adversely affected.

2. Compensation

You shall be entitled to an all inclusive annual gross compensation of **Rs.3,50,000/- (Rupees Three Lakhs Fifty Thousand only).** A detailed break-up of your compensation structure is given in the Annexure (I) to this letter. The Compensation package shall be governed by the Policies and Guidelines of the Company presently applicable and as may be modified from time to time.

Further you are required to strictly maintain the secrecy and ensure that you do not divulge or communicate in any manner, any information regarding your remuneration or terms of employment to any other employee of the Company or other public at large. If found revealing any of the above information, strict disciplinary action shall be taken against you including but not limited to termination of your employment without any notice.

3. Probation Period

You will be on probation for a period of 12 months from the date of your joining. The probation may be extended for a further period or periods as determined by the Management and you will continue to be on probation until an order of confirmation in writing is issued, notwithstanding the expiry of the probation period.

On satisfactory completion of the probation period and on being found suitable in the post to which you have been appointed by this letter, you will be determined and fixed in appropriate manner. The management may place you in any scale of pay consisting various elements or allowances or consolidated salary from time to time at their discretion fixing you at the appropriate stage as they consider it proper.

4. Notice period

During Probation Period

Your services are liable to be terminated by the company without assigning any reason by giving **60 (Sixty)** days notice period or payment of gross monthly salary in lieu thereof on either side. However, in the event of your resignation, you shall have to serve a notice for **60 (Sixty)** days,but the Company in its sole discretion shall have an option to accept the same and relieve you prior to completion of stipulated notice period of 60 days,without any pay in lieu of notice period.

UANGTEMAN

Appointment Letter

Private & Confidential

31 December 2018

Ms.AnushaGajja,
Hyderabad.

Dear Ms. Anusha,

With reference to your application and subsequent interview with us, we are pleased to appoint you as **Software DeveloperIntern** in **Uangteman Technologies Private Limited., Hyderabad** on the following terms and conditions.

Date of Joining: Your joining date will be on **7th January 2019**.

End date: **7thApril2019**. On submission of project report you will be acquiring a certificate from company.

Salary: As an internship of 3 months, stipend would be **Rs. 8000/- PM(Rupees Eight Thousand Only)**.

Place/Transfer: Your present place of work will be at **Uangteman Technologies Private Limited., I Labs, Hyderabad Technology Park, Level 2, Oval Building, Plot No. 18, In orbit Mall Road, Hyderabad,**but during the course of the service, you shall be liable to be posted / transferred anywhere to serve any of the Company's Projects or any other establishment in India or outside, at the sole discretion of the Management.

With best wishes,

For UangtemanTechnologiesPvt. Ltd.

Vijay Kumar Donthineni

AVP, Delivery Manager

Accepted and Agreed

Anusha Gajja

Dated: 3/01/19

Uangteman Technologies Pvt. Ltd.
D.No.101, Plot No.156, 157, SYNO-3, Saranya Apts,
Behind Turbo Machinery, Bachupally, Hyderabad
Telangana-500092
contact@uangteman.com | www.uangteman.com

Gmail

Deepika Bomma <deepikabomma10@gmail.com>

l from Cognizant!! Intern Joining on 19th Jan 2019

essage

c@cognizant.com <c2c@cognizant.com> Fri, Jan 11, 2019 at 8:56 PM

Dear Candidate,

Greetings from Cognizant, the fastest growing top tier IT Services and BPO Company.

We are pleased to inform you that your joining date is **19th Jan 2019.**

Reporting Time: 8:30AM

Reporting Venue: Cognizant Technology Solutions India Pvt Ltd.

Plot No: 129 to 132, APHB Colony.

Krida Conference Hall,

4th Floor, Phase-2 (Block-3),

DLF Building, Opp to Old CMC Office

Gachibowli,

Hyderabad – 500032

Contact Person : : Gopi/Venkat/Venu

Documents Required -

Please bring the following at the time of joining:

1 Bank Passbook

2 Address proof - Passport/Driving License/Pan card (Original & Photo Copy)

3 Passport Size Photo

4 Photocopy of college ID card and 1 Government id proof.

Note:

Please Ignore the Previous Mail. Your Date of Joining is 19th Jan 2019.

For any queries please reach us via your placement officer

Please bring a copy of this mail at the time of joining

Dress code is business formal or business casuals.

Regards,

Gmail

Nihitha Veeramachaneni <v.nihitha@gmail.com>

Samsung R&D Bangalore _ Joining form (6 months Internship) - Date of Joining: 10th Jan

4 messages

Sumit Premi <sumit.premi@samsung.com> Fri, Dec 14, 2018 at 5:18 PM
To: Sumit Premi <sumit.premi@samsung.com>

Dear All ,

Greeting from Samsung R&D Bangalore !

ongratulations!

We're pleased to extend an internship offer to you !

DOJ: 10-Jan-2019

Internship Period – 10th Jan 2019 to 18th June .2019

Stipend: INR 35,000 per month

In addition to the stipend, below are the other perks/benefits

- We shall be getting your tickets booked.
- First week accommodation.
- Eligible to use company cafeteria- free of cost.

Below is the link to fill the joining form . Please complete the form by 15th Dec

https://goo.gl/forms/sbcsRH7v3xNttGDx2

Our Travel team will get in touch with you , once you fill the joining form for ticket booking . We shall be providing accommodation for first week (6 nights & 7 days)

ACCOLITE
Only the best technical minds

CONFIDENTIAL

Date: 18th December 2018

Sai Deepa Bhavani Peri

Subject: Offer of Internship

Dear Sai Deepa,

Based on our recent discussions, we are pleased to offer you an Internship with Accolite Software India Pvt. Ltd. The internship is a significant experience in the course of your developing into a qualified professional. Therefore we do hope you will use this opportunity to add value mutually to and from the organization.

The details of your internship with us are as follows: -

1. Date of Joining: 3rd January 2019
2. Duration: 3rd January 2019 – 3rd April 2019
3. Location: Hyderabad
4. Stipend: INR 20,000 per month

Probation:
You shall initially be under probation for a 30-day period from the date of joining our service. The Company reserves the right to terminate your internship at any time during your probation. You will be required to give 15 days' notice in writing to Accolite in case you wish to resign / leave the services. In the event of your failing to give notice as stated herein above, Accolite may deduct from the dues payable to you. The decision of Accolite Management in this regard will be final and binding on you. On satisfactory completion of your probation, your Appointment to Internship will be deemed confirmed. Accolite reserves the right to confirm your appointment to internship and terminate this even before the expiry of the said 30-day period.

During your internship, you will be required to comply with the Company's rules, regulations and such other practices, systems, procedures and policies that the Company communicates to you, all of which may, from time to time, be added, amended and/or terminated by the Company at its discretion. You will be paid the specified Compensation (less required deductions and withholdings) at the end of each month.

This letter of offer shall not be constructed as creating or evidencing any separate or independent obligation of the Company or any other person or entity to hire or to retain you as its employee, consultant or otherwise for any specified period of time or to assign to you any particular duties or responsibilities. Your performance will be reviewed from time to time during your internship. The Company reserves the right to terminate your internship at any time, if it not satisfied with the quality of services rendered by you. In case you wish to resign / leave the services, you will be required to give 15 days' notice in writing to Accolite. In the event of your failing to give notice as stated herein above, Accolite may deduct from the dues payable to you. The decision of Accolite Management in this regard will be final and binding on you.

Gmail

Hari Prasad <atsrgorantla94@gmail.com>

Fwd: Mail from Cognizant!! Intern Joining on 19th Jan 2019

message

ishitha Gorantla <rishitha.sai954@gmail.com>
o: Hari Prasad <atsrgorantla94@gmail.com>

Tue, Jan 15, 2019 at 10:46 AM

---------- Forwarded message ---------
From: <c2c@cognizant.com>
Date: Fri, 11 Jan 2019 at 8:57 PM
Subject: Mail from Cognizant!! Intern Joining on 19th Jan 2019
To:

Dear Candidate,

Greetings from Cognizant, the fastest growing top tier IT Services and BPO Company.

We are pleased to inform you that your joining date is **19th Jan 2019.**

Reporting Time: 8:30AM

Reporting Venue: Cognizant Technology Solutions India Pvt Ltd.
Plot No: 129 to 132, APHB Colony.
Krida Conference Hall,
4th Floor, Phase-2 (Block-3),
DLF Building, Opp to Old CMC Office
Gachibowli,
Hyderabad – 500032

Contact Person : : Gopi/Venkat/Venu

Documents Required -
Please bring the following at the time of joining:

1 Bank Passbook
2 Address proof - Passport/Driving License/Pan card (Original & Photo Copy)
3 Passport Size Photo
4 Photocopy of college ID card and 1 Government id proof.

Note:
Please Ignore the Previous Mail. Your Date of Joining is 19th Jan 2019.
For any queries please reach us via your placement officer
Please bring a copy of this mail at the time of joining

J.P. Morgan

January 8, 2019

Reddy, Sneha
102 SANJEEVANI APARTMENTS
HYDERABAD, Andhra Pradesh 500028

Dear Sneha,

Your Internship by J.P. Morgan

Congratulations on joining the J.P. Morgan family. We are pleased to confirm your internship with J.P. Morgan Services India Private Limited (the "Company").

You will find your personal internship terms outlined in Appendix A with general internship terms and conditions in Appendix B. Please note these terms and conditions supersede any verbal discussions you may have previously had with any JPMorgan Chase employee with regards to your internship arrangements.

A number of important policies will apply to your internship with the Company, including the Personal Account Dealing Policy and the Code of Conduct. We provide more information about these policies in Appendix C and it is essential that you carefully read and understand their requirements. By signing this letter, you confirm that you have read and understood and agree to be bound by these policies. In addition, you will be required to abide by all other Company policies and regulations (including JPMorgan Chase group of companies (the "Group") policies) and with applicable law.

Should you have queries in relation to your internship terms, please contact Paramveer Narang at +91 [illegible]790[illegible] For queries about your benefits or Company policies, please contact our accessHR hotline at 000800440521[illegible] (toll free) or +1 212-552-5100 (international).

Please be reminded your internship terms should be treated with the strictest confidence. To accept this offer of internship, please click on the 'Accept' button at the bottom of this page on or before January 15, 2019.

We are excited to welcome you to our Company and take this opportunity to wish you every success in this first step of your career with us.

*This is a computer generated communication and does not have a signature.

Gmail

Tanishka Vegunta <tanishka.ve@gmail.com>

Fwd: Internship Program@ NCR

Keerthana reddy Varakala <keerthanavarakala@gmail.com> Thu, Jan 24, 2019 at 10:24 AM
To: harshavardhanrao45@gmail.com
Cc: reddyvineeth6@gmail.com, shree.avanthika9@gmail.com, ravichandrankallem@gmail.com, abdul.wahed11314@gmail.com, saidheerajnvs29@gmail.com, sahithiarkiti18@gmail.com, sharanya.gandla05@gmail.com, padalasoumya123@gmail.com, vangaripallavi27@gmail.com, nikkilaxmi@gmail.com, sajjasoumya@gmail.com, shravanthi.musti@yahoo.com, mymotoplay@gmail.com, meghnaraman22@gmail.com, tanishka.ve@gmail.com, psspratik@gmail.com

From: Gajapathi Raju, Vishnu
Sent: Wednesday, January 23, 2019 7:59 PM
To: Nln Reddy <nlnreddypo@gmail.com>
Subject: Internship Program@ NCR

Dear Sir,

We have finalized internship program with all shortlisted students from CBIT from 31st Jan 2019 .

We are doing this program with CDAC and discussed with students already couple of times .

Please inform respective HOD about the internship program which is starting from 31st Jan 2019 .

Regards,

Vishnu

Gmail

varalakshmi vakkalagadda <varalakshmisept@gmail.com>

Samsung R&D Bangalore _ Joining form (6 months Internship) - Date of Joining: 10th Jan

3 messages

Fri, Dec 14, 2018 at 5:18 PM

Sumit Premi <sumit.premi@samsung.com>
To: Sumit Premi <sumit.premi@samsung.com>

Dear All ,

Greeting from Samsung R&D Bangalore !

Congratulations!

We're pleased to extend an internship offer to you !

DOJ: 10-Jan-2019

Internship Period – 10th Jan 2019 to 18th June .2019

Stipend: INR 35,000 per month

In addition to the stipend, below are the other perks/benefits

- We shall be getting your tickets booked.
- First week accommodation.
- Eligible to use company cafeteria- free of cost.

Below is the link to fill the joining form . Please complete the form by 15th Dec

https://goo.gl/forms/sbcsRH7v3xNttGDx2

Our Travel team will get in touch with you , once you fill the joining form for ticket booking . We shall be providing accommodation for first week (6 nights & 7 days)

Thanks & Regards

Sumit Premi

Talent Acquisition

Samsung R&D Institute Bangalore

Cognizant

Cognizant Technology Solutions India Private Limited
DLF Building, Block-1, Plot # 129 to 132,
APHB Colony, Gachibowli,
Hyderabad 500 019, India
Telangana
CIN-U72300TN1994PTC026590
Tel: +91 40 4451-4444
Fax: +91 40-4024-9407
Email: cognizantindia@cognizant.com
Website:www.cognizant.com

14-January-2019

Ref No: 12485473

Hemanth Reddy Loka
B.Tech/B.E., Information Technology
Chaitanya Bharathi Institute of Technology

Dear **Hemanth Reddy**,

Further to the internship selection process, we are pleased to provide you with an opportunity of Internship with us for **19-January-2019** to **31-May-2019** during which you will be offered a stipend Amount of **INR 12000** per month.

Please also note that:

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- Internship duration may be shortened, based on the business demand and your performance. Internship performance would be reviewed periodically for continuation of your service.

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You will also be required to submit the following documents at the time of reporting;

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- Photocopy of your Certificates / Mark Sheets in support of your Educational Qualification(s)
- 2 Passport-size photographs

This internship is offered as an extension of educational training program for academic purposes. As part of your internship, you may be required, to travel to other locations within India. Please do not hesitate to call us for any information you may need.

We wish you good luck.

Yours sincerely,
For Cognizant Technology Solutions India Pvt. Ltd.,

B. Suresh

Suresh Bethavandu
Global Head-Talent Acquisition

I have read the offer, understood and accept the above mentioned terms and conditions

Signature: Hemanth Reddy

Date: 01/19/2019

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11-Dec-2018

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Villa No. 6, Aditya Fortview, Puppalaguda,Manikonda
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Job Grade:

sition is a Grade 09

Reporting To:

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Business Unit:

CTO

Location:

HYDERABAD - OFFICE

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Date: 05-Mar-2019

Experience Letter

This is to certify that Durga Prasad Patlolla has worked with Trell from 12th December, 2018 to 18th January, 2019 as a Trell Campus Ambassador.

During the tenure, Durga with full capacity has undertaken multitude of responsibilities and spearheaded various activities for Trell.

Durga's commitment to learn and willingness to go the extra mile for the best results and detailing are characteristics we found very valuable.

Regards,

Pulkit Agrawal
Co-Founder & Director,
Trell Experiences Pvt. Ltd.
Email: pulkit@trell.in

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VSF ONLINE SERVICES PRIVATE LIMITED

CERTIFICATE FOR INTERNSHIP

This is to certify that **Mr Avinassh Bharadhwaj** student of **Chaitanya Bharati Institute of Technology, Branch: IT, 3rd year** has successfully completed 8 weeks (from 5th September 2018 to 5th November 2018) Internship program at our company.

During the Internship, **Mr Avinassh Bharadhwaj** worked as a part of UI development team in our company and his contribution to the team is satisfying.

We wish him all the best for his future endeavours

MADUGON
A SAIVIVEK

Digitally signed by MADUGONDA SAIVIVEK
Date: 2019.01.26 22:50:34 +05'30'

Director,
VSF Online Services pvt. ltd

Office Address:
-4-80/1,
Maruti Nagar,
Anantapur-Andhra Pradesh-515001

Phone number: 9908882308,
8500336815

aone

NEXTGEN RIDESHARING

WORK EXPERIENCE CERTIFICATE

Date: 29th July 2019

This is to inform whomsoever it may concern and certify that **Mr. Diyanshu Alok** was working as an Intern with **AONE TECH SOLUTIONS, Hyderabad, India** as a **Mobile Application Developer** from **19th June 2019** to **26th July 2019** as per the personnel files and company's employment record.

During his employment, we found **Mr. Diyanshu Alok** to be a professional, knowledgeable and result oriented with a theoretical and practical understanding of work requirements.

He has a friendly, outgoing personality, very good sense of humor and works well as an individual or member of a team as required by the management.

Overall, **Mr. Diyanshu Alok** performed his duties and responsibilities cheerfully with attention to detail at all times. With his enthusiasm to work, learn and progress, I am certain that he would be a great employee to any enterprise.

On behalf of the company, I take this opportunity to wish **Mr. Diyanshu Alok** all the very best in his future career endeavours.

Head Operations,

For AONE TECH SO...

Proprietor

AONE TECH SOLUTIONS
Hyderabad, Telangana

AONE TECH SOLUTIONS,
Corporate Office: 4th Floor, Vasista Bhavan, Opp.Charcoal BBQ, Near DLF Gate 1,
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28th June, 2019

TO WHOM SO EVER IT MAY CONCERN

This is to certify that Mr. Manoj Kumar Janapala has successfully completed the project offered at Virinchi Limited, on "**Advance America Qtrack Mobile Project**" under the guidance of **Mr. Shiva kumar Injarapu**, as a ~~part of~~ his course curriculum beginning from 30th May, 2019 to 30th June, 2019.

His conduct was found to be very good and enthusiastic during the Project Period.

We wish his bright and successful career ahead.

For
Virinchi Limited

VIRINCHI LIMITED Hyderabad

Madhika
Senior Manager - HR
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Hyderabad

TO WHOM IT MAY CONCERN

3/4 IT-1

This is to certify that Mr. /Mrs. D. MANI CHANDANA 160117737310

S/O/D/O D. VENKATESWARLU, Roll. No. - 1.60118E+11

A student of CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

Has successfully completed his/her project in MACHINE LEARNING, during his/her internship at this Company.

Names of the projects he/she has worked on:

1. CALIFORNIA HOUSING PRICE PREDICTION
2. DIGIT RECOGNISER

During the period of his/her internship programme with us he/she was found punctual, hardworking and inquisitive.

We wish him/her every success in life.

Duration: 30 Days

Marks Awarded (25): 24

Date: 30th July 2019

Kunal Singh

CPO, CodeMania

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160116737110

Aspirevision Tech Education Pvt. Ltd.

To Whomsoever It May Concern

This is to certify that "**E Sree Harsha**" from "**Chaitanya Bharathi Institute of Technology**" has successfully completed internship at **Aspirevision Tech Education Pvt. Ltd** from **13 June to 2018 14 July 2018**. During internship he was exposed to the project entitled "**Service Request**" on **Machine Learning using Python** technology which is an original work carried out by E Sree Harsha under the guidance of his mentor at **Hyderabad**.

The matter embodied in this project is a genuine work. We found his extremely inquisitive and hard working. He was very much interested to learn the functions of core division and also willing to put best efforts to get in to depth of the subject to understand it better and his association with us was very fruitful, we wish all the best him in future endeavors.

Regards

ASPIREVISION TECH EDUCATION PVT. LTD. www.mtaeducation.in

Rakhi Oberai
H R Manager
Aspirevision Tech Education Pvt. Ltd.

160116737119

Aspirevision Tech Education Pvt. Ltd.

To Whomsoever It May Concern

This is to certify that **"Vishwanath R Boga"** from **"Chaitanya Bharathi Institute of Technology"** has successfully completed internship at **Aspirevision Tech Education Pvt. Ltd** from **13 June to 2018 14 July 2018.** During internship he was exposed to the project entitled **"Service Request"** on **Machine Learning using Python** technology which is an original work carried out by Vishwanath R Boga,under the guidance of his mentor at **Hyderabad.**

The matter embodied in this project is a genuine work. We found his extremely inquisitive and hard working. He was very much interested to learn the functions of core division and also willing to put best efforts to get in to depth of the subject to understand it better and his association with us was very fruitful, we wish all the best him in future endeavors.

Regards

ASPIREVISION TECH EDUCATION PVT. LTD. www.mtaeducation.in

Rakhi Oberai
H R Manager
Aspirevision Tech Education Pvt. Ltd.

Investigation of Fracture Parameters of Jute/Glass Reinforced Hybrid Composite and Analysis by Using FEA

Venkata Sushma Chinta, P. Ravinder Reddy, Koorapati Eshwara Prasad and Krishna Sai Vadapally

Abstract These days the interest of people has shifted toward using natural fibers as reinforcement in the preparation of polymer composite material. Having superior properties such as lower density, higher stiffness, better mechanical properties and since the natural fibers are abundantly available, being renewable and biodegradable, the natural fiber-based composite preparation has become a wide area for research activity. This paper deals with the testing and analysis of the single edge notch bend specimen for the estimation of fracture toughness of the material. Six SENB hybrid composite specimens made of glass fibers, jute fibers and epoxy are prepared as per ASTM D-5045. Then, the models of hybrid composite are created in ANSYS to find *J*-integral and stress intensity factor. The purpose is to retain sufficient mechanical properties by adding layers of glass fiber, at the same time ensuring a lower cost and lower weight by reinforcing intermediate layers of jute fiber in it. Determining the mechanical characteristics of hybrid composite laminate was carried out by three-point bending test so as to compare it with ASTM D-5045 test method's manual. Wherein, the results of the test specimens have satisfied the necessary conditions put forth by the test manual. Mechanical characteristics obtained with hybrid jute reinforced glass laminates enable the substitution of glass fiber by other natural fibers for moderately loaded applications to combine performance and economy.

Keywords Jute/glass fiber · Hybrid composite · SENB · *J*-integral · Stress intensity factor

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Evaluation of Mechanical Properties of Tailor Welded Sheet Metal Blanks

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Abstract. A tailor welded blank consist of two or more sheet metals which are welded together prior to forming. The sheets which are welded together may be different in size, shape and even in thickness also. The blanks may be also differing in sense of coating and material grade also. This different blanks are welded together to form in to one continuous blank. In industries since last long years the materials which are used for preparing tailor welded blanks in general are combinations of mild steel to stainless steel with different grades. Also the common materials which are used for making tailor welded blanks are generally aluminium alloys with different grades or it may be combination of aluminium and steel alloy sheets. Most tailor welded blanks today embody a multiple thickness design in order to eliminate the use of extra reinforcing components. The advantages of using tailor welded blanks are numerous, they ensure that the components are light, stronger, and provide required functionality at lower cost than parts made from monolithic pressed sheets, as well as improving structural integrity, safety and corrosion resistance in specific areas. In an automotive application, Tailor welded blanks eliminate the need for reinforcement, resulting in an overall reduction in vehicle body weight. The use of different strength or thickness in a single part can simplify the whole structure of a vehicle. Low car weight means improved fuel economy that is very important to today's energy consumption. Decrease of automobile parts number. This paper presents the tailor welded blanks of steel alloys tensile specimens are prepared and tested through uniaxial tensile test. Determined mechanical properties of tailor welded sheet metal blanks and also studies done on those properties.

Keywords : Tailor welded blanks, Mechanical properties, TIG welding.

1. Introduction

The material selection criteria depends on the results of tensile tests for applications of engineering. The specifications of materials are included in tensile properties for ensure the quality of products. The study of behavior of material under varying loads apart from uni-axial tension(1-5).The primary concern of material is generally strength of materials. The strength is measured in terms of stress, it is caused to plastic deformation of material. The ductility also another important parameter, which is study of material

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EVALUATION OF INTERLAMINAR FRACTURE TOUGHNESS OF E-GLASS EPOXY COMPOSITE MATERIAL UNDER MODE 1 LOADING

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ABSTRACT

Delamination is one of the major failure modes seen in the laminated polymeric matrix composite (PMC). Accurate prediction of delamination , initiation and propagation is important for the design and analysis of robust composite structures. This paper examines critical load and corresponding displacement of double cantilever beam (DCB) composite specimens made of glass/epoxy of two different layups. Experiments were conducted on these laminates, and the fracture energy, G_{IC} , was evaluated at the crack tip. The applied load-displacement history and crack extension to estimate fracture energy is a requirement. Reduction scheme as Modified Beam Theory is used to calculate the Energy Release Rate. based on cubic and power law are also proposed to determine Young's modulus and energy release rate and found good agreement with the published and test results.

Keywords**:** *Delamination, Double Cantilever Beam, Fracture Energy Modified Beam Theory, Reduction Scheme .*

1 . INTRODUCTION

Delamination is a failure mechanism in which the laminae separate due to poor inter-laminar fracture toughness and inter-laminar stresses and results in loss in stiffness, loss of strength, and the expected life of material. The critical strain energy release rate is the generally accepted measure of total energy required to initiate a delamination in the material, and is denoted by the symbol G. This value has been found to depend on the mode of delamination which happens in 3 modes-mode1(opening mode),mode 2 (shear),mode3 (tear). Thus there are three G, values: G , G_a, and G_{mc} for mode 1, mode II and mode III respectively. Many aspects of delamination have been studied, including various test methods for different modes, experimental data reduction methods, material effects, environmental effects, and effects of various testing parameters, fiber orientation, stacking sequence, and so on.

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ANALYSIS OF AXIAL FLOW FRP FAN BLADE MATERIAL WITH JUTE FIBER REINFORCEMENTS AND INVESTIGATION OF MECHANICAL PROPERTIES

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Abstract - The axial flow fans are widely used for providing the required airflow for heat and mass transfer operations in various industrial equipment and processes. Due dimensional instability of metallic impellers now a day's fan blades are fabricated with glass fiber reinforced plastics (FRP). To reduce the after effects of FRP blades on the environment necessitates the use partial reinforcement of natural fibers in FRP blades. This paper deals with the analysis of FRP blade material with partial jute layer reinforcements and estimation mechanical properties like tensile strength, bending strength by using ANSYS.

Keywords - Axial Flow Fan Blade Material, Fiber Reinforced Plastic (FRP), Jute Fiber, Glass Fiber

I. INTRODUCTION

Composites are one of the most widely used materials because of their versatility to different situations and the relative ease of combination with other materials. Recently there has been a greater inclination towards natural fiber reinforced plastic composites because these are environmental friendly and cost effective to synthetic fiber reinforced composites. Additionally, Natural fibers have lot of advantages over traditional fibers in terms of low cost, low density, biodegradable and easily processed.

They have been received in many industries such as packaging, automobile and construction but natural fibre composites are also finding its way into sport, aerospace, boat and electronic industries too. Rafiquzzaman [1], Sanjay [2] was found that the mechanical properties of the jute/glass composite were close to pure glass specimen and recommended the partial jute reinforcement in place of glass fibers for moderate load bearing applications. MazharulIslam [3] studied on Soil degradation of jute/glass hybrid composite showed moderate degradation and pure glass composite showed very little degradation.
Ali Reza [4] in his study found that FRP is the good structural material for cooling tower blades due to its superior performance in sea water corrosive environment. From the economics point of view though the construction cost is a little higher, could be easily balanced by less maintenance costs of FRP structure considering its higher durability in hostile environments. From literature it is understood that partial reinforcement of glass fibers with jute fibers does not affect the mechanical properties much and soil degradability increases. So, in this work an attempt is made to find the mechanical properties of conventional FRB blade material with partial jute reinforcements by using ANSYS.

II. FRP BLADE MATERIAL

The necessary raw materials for the FRP fan blade include glass fibre in various forms like woven rovings, glass rovings, chopped strand mat, unidirectional glass layers and resin (epoxy), hardener, surface treatment agents etc. All the raw materials are available indigenously.

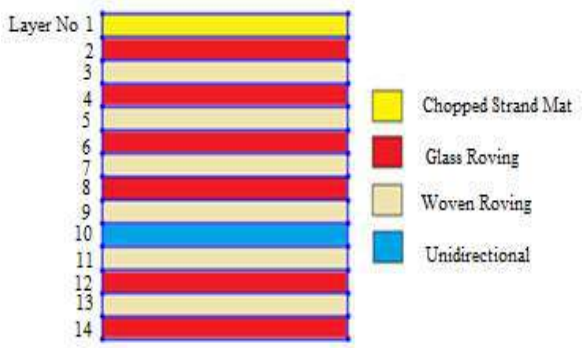

Fig.2.1 Stacking sequence of FRP blade (C0)

In this work the material of 18 feet FRP fan blade (C0) is considered. It consists of 14 layers of glass fibers of different forms with stacking sequence as shown in Fig.2.1.

III. EXPERIMENTATION

Test Specimens are prepared as per IS 1998-1962 [5] standard with material (C0) to find the maximum load at which the specimen fails.

Fig.3.1. Specimen for Tension test (C0)

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ICAMM_2016

Prediction of angular error in wire-EDM taper cutting of AISI D2 tool steel by RSM approach

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[b]*Department of Mechanical Engineering, CBIT, Gandipet, Hyderabad, TS, 500075, India*

Abstract

Taper-cutting is one of the most important application of wire electrical discharge machining (WEDM) process used for producing precise complex geometries with inclined surfaces in hard material parts that are extremely difficult to machine by conventional machining process. The wire is subjected to deformation during taper cutting operation leading to deviations in the angular dimensions and loss of tolerances in machined parts. For the correction of error time consuming experimental trial-and-error methods are currently adopted by WEDM machine manufacturers. So, to reduce the experimental load experiments were carried out to find the effect of process parameters such as taper angle, geometrical thickness and servo voltage on response variables such as angular error and cutting speed on AISI D2 tool steel using statistical design of experiments. The experiments were designed using Response Surface Methodology (RSM) – Central Composite design (CCD) involving three variables with five levels. An attempt has been made to develop regression model for relating the responses to the process parameters. Separate analysis of variance (ANOVA) is used to analyze the effect of parameters and contribution of each parameter affecting the responses is calculated. Results show that part thickness and servo voltage are the most influencing variables in the study.

Selection and/or Peer-review under responsibility of ICAMM-2016.

Keywords: Wire EDM; Tolerances; Taper Cutting; Cutting Speed; Angular Error; Response Surface Methodology

1. Introduction

Wire electrical discharge machining (WEDM) is an important technology, which demands high-speed cutting and high-precision machining to realize productivity and improved accuracy for manufacturing geometrically complex and hard material parts that are extremely difficult to machine by the main stream machining processes.

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Selection and/or Peer-review under responsibility of ICAMM-2016.

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International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Multi-objective optimization of WEDM process parameters for taper cutting of AISI D2 tool steel

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Abstract

Wire electrical discharge machining (WEDM) process is one of the most popular method for the producing complex geometries in hard and wear resistant materials such as those used in tooling industry. This taper cutting involves in making of inclined surface, and it is particularly significant in the manufacturing of tooling that requires draft angles. In the present paper, experiments were conducted in order to find the effect of process parame- ters such as taper angle, geometrical thickness and servo voltage on response variables such as angular error and cutting speed on AISI D2 tool steel using statistical design of experiments. The experiments were planned using Central Composite design (CCD) which is part of Response Surface Methodology (RSM) – involving three variables with five levels. Multi objective optimization was conducted for maximizing the Cutting speed and minimizing the angular error using genetic algorithm. The optimization procedure leads to creation of non-dominated optimal points which gave an insight regarding the optimal operating conditions of the process.

Keywords: *Wire EDM; Taper Cutting; Cutting Speed; Angular Error; Response Surface Methodology; Genetic Algorithm.*

1. Introduction

Wire electrical discharge machining (WEDM) has been found to be an extremely potential electro-thermal process in the field of conduc- tive material machining which is employed for the parts demanding higher accuracy levels with varying hardness or complex shapes. Ta- per cutting is one of the most important applications of WEDM pro- cess that involves the generation of inclined surfaces and possesses significant bearing in manufacturing of tooling requiring taper or draft angles. The taper angle is achieved by applying a relative dis- placement between the upper and lower guides of the wire as shown in Fig. 1. The maximum angle that can be cut depends upon part thickness, but values about 30° can be easily achieved [2].

The main factors contributing to the geometrical inaccuracy of the WEDMed part are the various process forces acting on the wire caus- ing it to depart for the programmed path [3]. The problem of taper cutting was first time proposed by Kinoshita et al. [4] who developed a linear model for wire deformation neglecting the forces produced during the process. Computer simulation software for the analysis of error in wire EDM taper-cutting was presented by Sanchez et al. [5]. Two models for the prediction of angular error in WEDM taper cut- ting ware developed by Plaza et al. (2009). Nayak & Mahapatra [6] adopted Multi response optimization approach to determine the op- timal process parameters in WEDM taper cutting process.

Since the wire is subjected to deformation in wire EDM taper cutting process, deviations are obtained in the inclination angle of machined parts. As a result, the machined part losses its precision. Hence, se- lection of the process parameters is a major issue in the field of taper cutting operation in WEDM. However, the traditional Taguchi meth- od cannot solve the multi-objective optimization problem. To over- come this limitation genetic algorithm is applied to simultaneously optimize the process parameters for minimizing angular error and maximizing cutting speed during taper cutting in WEDM.

The present work is focused on investigating the effect of various process parameters of WEDM such as taper angle, part thickness and servo volt- age (SV) on responses such as angular error (AE) and cutting speed (CS) in taper cutting of AISI D2 tool steel. Further, angular error (AE) and cutting speed (CS) were exposed to multiple objective optimization using genetic algorithm (GA) approach. RSM model aids in process under- standing while the Pareto optimal solutions generated from GA approach facilitates to identify optimal operating conditions.

2. Materials and method

Experiments were conducted on AISI D2 steel using Electronica Sprintcut WEDM and brass wire electrode of 0.25 mm diameter. Deionised water was used as a dielectric medium. The work pieces were prepared by cut- ting into the sizes as per the experimental plan as shown in Table 1 and 2 with 10mm width (w) and then grounded in order to get good finish. The lower and upper surfaces of the work parts are grounded, so that they can be used as a reference for measurement of the angle. Angular error (AE) and Cutting speed were studied for optimizing machining parameters of WEDM taper cutting process.

Angular measurements have been carried out on a Zeiss Prismo-5 model CNC Coordinate Measuring Machine. Two level full factorial design with 6 central runs and 6 axial runs leading to central composite rotatable de- sign was used to conduct experiments. Coded and actual levels of process parameters are presented in

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Parametric Analysis of Friction Stir Welding Process

Pavan kumar Thimmaraju[a]*, Krishnaiah Arkanti[a], and G.Chandra Mohan Reddy[b]

[a]*Department of Mechanical Engineering, Osmania University, Hyderabad, Telangana, 500007, India*
[b]*Department of Mechanical Engineering, C.B.I.T, Hyderabad, Telangana, 500075, India*

Abstract

In this paper a thermo- mechanical model is created for friction stir welding process using ANSYS APDL commands using FEA techniques is presented. Several characteristics of FSW are studied, including tool-work piece surface interaction, heat generation because of friction during the operating conditions of the FSW process, plastic deformation and plastic heat generation due to the non-linear nature of the materials used in finite element analysis. A nonlinear direct coupled-field analysis is performed, as thermal and mechanical behaviours during the friction stir welding process are mutually dependent and coupled together. ANSYS APDL macro is created in such a way that it can be used for multiple design variants and load parameters in order to perform the FSW study for multiple design variants. The proposed model is then utilised to carry out parametric studies to know the effect of various process parameters like welding speed, total rate of heat input and location of the clamping on the temperature distribution and residual stress in the work piece. With the data obtained from the simulated models, various observations are made by changing the input process parameters. A transient thermo mechanical analysis is performed using coupled field elements for different tool diameters and different sizes of the base plates that are to be welded using FSW.In this project FSW process is studied in various stages DWELL, PLUNGE and TRAVERSE by solving the finite element model in separate load cases. To avail the plastic heat bi-linear isotropic material properties are used. From the results obtained from this study, it is observed that the heat input, for making good welds, is mainly restricted and controlled by the lower bound of the temperature. Also it is found that keeping the clamping position closer to the weld is better in order to keep the peak residual stresses at a lower limit. Further, it is found that adopting nonlinear models resulted in a more realistic solution than the usage of linear models as a wide temperature range is used in the simulation process which is in general highly non-linear and wherein convergence becomes an important problem to be dealt with.

Keywords: Friction stir Welding,Parametric Analysis,FEM,Coupled Field Analysis

1. Introduction

Friction Stir Welding (FSW) is a non-fusion welding process unlike conventional joining process which are fusion in nature and is derivative of friction welding and produces good quality lap and butt joints[1].Friction stir welding is a joining process which is developed and patented by TWI Ltd,Cambridge,UK in 1991[2].The

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EXPERIMENTAL INVESTIGATION OF MAJOR AND MINOR STRAINS IN DIFFERENT REGIONS OF DEEP DRAWN CUPS

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ABSTRACT

Drawing is one of the most important processes for forming sheet metal parts. It is used to manufacture parts in industries such as automobile, aerospace and home appliance, etc. The parts produced include cooking pans, kitchen sinks, automobile panels, gas tanks, fountain pen caps, etc. A deep drawn cup has different regions like, flange, corner radius, side walls and flat bottom. The values of stresses and strains vary throughout the cup (i.e in different regions). The objective of the present work is to perform an experimental investigation of major and minor strains in the different regions of deep drawn cups. In this work, the cups are drawn with different blank thickness and major strain and minor strain are measured in different regions of the cup. Also a comparison is made by drawing graphs between major strain(y axis) and minor strain (x axis) for cups drawn with different sheet thickness. By performing this study it will be possible to find out which region of the cup is strained maximum, hence where exactly fracture is likely to occur. Also, areas which are not stressed can be identified and in those areas, heat treatment is not necessary. It will also be possible to know which sheet thickness can take a maximum and minimum amount of stresses and strains. The material selected for this work is Brass. The diameter and heights of cups drawn are 200mm and 40mm respectively. The sheet thickness selected is 0.71, 0.8and 0.88mm. This work was carried out at Metal industries, Sanathnagar, New modern stone company, Hyderabad and metal forming lab of CBIT. The studies revealed that the die corner radius, region (neck) of the cup has maximum strain. Hence this region is the source for a fracture to take place.

KEYWORDS: Deep drawing, Blank thickness, Blanking, Electrochemical etching, Major strain & Minor strain

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Original Article

INTRODUCTION

Deep drawing is one of the widely used sheet metal forming processes in the industries involved in mass production of cup-shaped components. During this process, a flat blank of sheet metal is shaped by the action of a punch forcing the metal into a die cavity. Deep drawn products, in modern industries usually have a complicated shape, so these have to undergo several successive operations to obtain a final desired shape. This process is used to manufacture complicated parts from sheet metal in many industries such as automobile, aerospace and home appliance. The parts produced include cooking pans, containers, sinks, automobile parts such as panels and gas tanks and so on. Figure 1 shows a schematic diagram of the deep drawing process.

The equipment for deep drawing processes involves a double action press, one for the blank holder and one for the punch. Both mechanical and hydraulic presses are used in manufacturing industry. The shape of a deep-drawn part is not just limited to a circle or square, but more complex contours are possible. However, as the complexity goes up, the manufacturing difficulties increase rapidly

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Influences of process parameters on weld strength of low carbon alloy steel in purged SAW

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Abstract

Submerged arc welding (SAW) is one of the most widely employed welding process in manufacturing industry due to its inherent advantages such as deep penetration, smooth bead and reliability with high quality. SAW is notable with a large number of process parameters, which act together in an intricate manner and influence the output performance, successively affects the weld quality. As quality is at high priority, it is important in selecting process parameters. In the present work, parametric optimization of main factors, viz. Open circuit voltage (OCV), wire feed rate (WFR), welding speed (WS) and nozzle to plate distance (NPD) and thus to study influences on weld strength. Taguchi's L_9 orthogonal array, at three levels, has been adopted to conduct experiments as part of design experiments. Experiments are conducted 'purging with CO_2 gas' in SAW to investigate the weld strength variations against the traditional SAW 'as weld' condition. The performance measure of control levels to select, are observed through S/N ratio, as the best cope with the noise to their effect. Analysis of variance (ANOVA) is calculated to make a note of significance parameter with contributions. The correlations are established between parameters and performance outputs using linear regression analysis. Mathematical models are developed and checked for their adequacy with the F-test, determined quantitatively and presented graphically. The direct and indirect effects of process parameters are presented in achieving desired weld quality. The models are validated through confirmation tests and predicted the results, are found within the limits.

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Keywords: Submerged Arc Welding, Design of Experiments, Regression Models, Analysis of Varince.

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Numerical Analysis On The Effect Of Various Parameters On Fracture Limit For Deep Drawn Cups ☆

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Abstract

Deep drawing is the process of converting a blank into cup shaped articles like kitchen sinks, cooking pans, automobile panels, gas tanks, fountain pen caps etc. Wrinkles and fractures are the major defects in deep drawn products. Fracture is the separation or fragmentation of a solid body into two or more parts under the action of stress. In deep drawn cups tearing is usually an open crack in the vertical wall which occurs near the base due to high tensile stress that causes thinning and fracture of the metals at this location. During this process the punch force acting on the bottom of the cup is transferred to the side of the cup. The narrow ring of metal just above the bottom of the cup is subjected to plane strain condition. As a result, failure of the cup easily happens in this zone due to necking induced by the tensile stress, leading to tearing. This type of failure can also occur on the flange as the metal is pulled over the sharp die corner. In addition to this sharp corner on the punch could also cause fracture of the cup along the corner. The objective of this work is to predict the fracture limit of deep drawn cups. This would help in preventing rejections in deep drawing industry. This can be achieved by setting the blank holder force appropriately. Also it would save material and reduce the total cost. In this work numerical simulations are conducted by considering five different parameters namely punch radius, die radius, clearance, coefficient of friction and punch diameter using finite element explicit solver LSDYNA. Modeling of the set up is done using hyper mesh. In this work simulations are carried out as per L-27 orthogonal array suggested by Taguchi. A combination of finite element method and Taguchi analysis is used to determine the influence of process parameters on fracture limit in deep drawing process. During analysis the value of optimum BHF is arrived by performing a number of trial runs. Also Column effect method and plotting methods are used for finding out the most influencing parameters and their interactions respectively for analysis. The studies reveal that punch diameter is most significant parameter for deciding fracture limit followed by die corner radius and clearance. In addition to this regression analysis is carried out for developing an empirical model using Minitab 17 for predicting fracture limit.

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Keywords: deep drawing, blank holding force, wrinkling, Taguchi approach, LSDYNA.

1.0 Introduction: Deep drawing is the process of converting a blank into cup shaped articles like kitchen sinks, cooking pans, automobile panels, gas tanks, fountain pen caps etc. Wrinkles and fracture are the major defects in

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Secure VM Migration to Improve Load Balancing in Cloud Environment

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Abstract : Cloud datacenters provide powerful computing power and required resources on demand but the average utilization of cloud servers is comparatively low. Some servers may be overloaded and others may be underutilized. Efficient Load balancing is required to improve the resource utilization and minimize the downtime. The virtual machine migration is one of the key aspect in cloud to balance the load among cloud servers. Securing the virtual machine (VM) in migration , minimizing migration time remain open issues. Virtual machine security issues need to be resolved when migrating a virtual machine in cloud. XACML can be used for defining role based access control policies for a VM to provide accessibility only to the authorized resources or users and proposed an XACML based algorithm for load balancing to improve the performance and security of the cloud services.

Index Terms **- Load Balancing, Cloud Servers, VM Migration, Security issues, XACML**.

I. INTRODUCTION

Cloud computing is Internet based computing for providing quality services to the users from any geographical location. Scalability is one of the challenging QOS parameter in cloud as the cloud is providing various hardware and software services through public or private clouds. Virtualization has improved the resource provisioning in cloud as the user can access the services from virtual machine and the assignment of tasks to virtual machine is the responsibility of the scheduling algorithm. The efficient scheduling must be done for task assignment by monitoring the load on the servers after every new assigned task and accordingly the load must be distributed among the number of servers otherwise the servers may lead to the issues of over loaded node (OLN) or under loaded node(ULN).To balance the load, The load must be transferred or migrated from one server to another which leads to the security issue. Dynamic consolidation of virtual machines (VMs) using live migration and switching idle nodes to the sleep mode allow cloud providers to optimize resource usage and reduce energy consumption.

The Assignment of tasks to VMs must consider the load of that physical machine and task assignment decision must be taken based on that load. Load balancing algorithms plays an important role in balancing the load among the cloud servers. Load balancer is the part of scheduling. The load of each cloud server must be monitored regularly and VMs. need to be migrated to balance the load among cloud servers.

Load Balancing can be static or dynamic. Static load balancing algorithms need prior knowledge of number of tasks need to be serviced and availability of number of servers. In Cloud Computing tasks need to be serviced dynamically so the static load balancing algorithms may not give efficient results. The dynamic load balancing algorithm is required which can schedule the tasks dynamically and balance the load accordingly among the cloud servers.

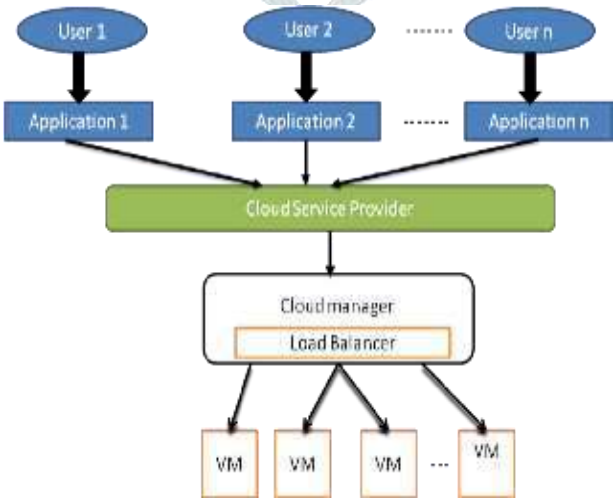

Fig.1 Load balancing in cloud

Challenges in Load Balancing

1. Overhead Associated: Overhead due to movement of tasks, inter process communication, overhead should be reduced so that load balancing algorithm works well.

2. Throughput: It is the amount of work done in fixed interval of time. Most of the algorithms tries to improve the throughput.

3. Resource Utilization: Resource utilization should be maximum for an efficient load balancing algorithm.

4. Scalability: The quality of service provisioning should not be effected as the number of users/jobs increases. The more number of nodes can be added flexibly without affecting the service.

5. Response time: Minimum response time is expected by the users as per service level agreement (SLA).

Limited resources on same physical machine running multiple VMs causes resource conflict due to which physical machine may fail to serve continuously. Hence, to avoid failures, VM migration is the solution to have continued and uninterrupted service. Different Migration techniques were proposed by various researchers to control the overloaded or under loaded issues in cloud computing. VM migration is to migrate memory and control of VM from one physical server to another without any service interruption. Downtime and total migration time should be considered when the migrated VM is in working condition.

VM migration can be active or passive.

Passive/Cold VM Migration: Migration of a powered-off virtual machine from current host/data store or both to a new host or data store.

Active/Live VM Migration: Live migration transfers the VM from one physical server to another without disconnecting/powered-off with the client so that downtime can be reduced and performance of cloud services can be improved using continuous availability of services which helps System administration in fault tolerance, online system maintenance, workload balancing, consolidation of VMs etc. However, vulnerabilities associated with live migration pose many security threats.

Live migration is an essential feature of virtualization, defined as a process of dynamically transferring running VMs from one physical server to another with little or zero downtime and without interrupting services running in VM. Downtime is the total time for which VM stops running. Most of the Load balancing algorithms were tried to minimize the make span and improve the throughput but VM migration and security issues are still need to be improved.

Benefits of Live Migration

1. Service Providers can be changed flexibly, can take advantage of low-price.

2. Offering service continuity in case of ceasing operation or natural disasters.

3. Cloud users can be connected to the nearest datacenter, regardless of the provider.

4. Processing sensitive data on a private trusted cloud while processing less sensitive data on a public cloud.

5. Borrowing resources from different providers in case of over-utilization or limited resources

All VM properties and attributes remain unchanged, in live migration including internal and external IP addresses, instance metadata, block storage data and volumes, OS and application state, network settings, network connections, and so on. In live migration process there are several authentication issue as well as active and passive attacks which exploits live migration process. The Main cause of this is lack of secure live migration protocol. Hence secure live migration protocol must be required for live migration having essential features like protected transmission channel, integrity of migration data and entity authentication. XACML role based access control policy is proposed for virtual machine while migrating from one server to another as XACML allow natural integration with the Cloud and Web Services security services infrastructure.

The rest of paper is organized as follows. Section II provides related work of load balancing algorithms, section III provides the related work pertaining to VM migration and security issues of live migration of VM, Section IV problem formulation, section V provides the proposed system design and section VI is conclusion and future work.

II. Related Work

Many load balancing algorithms were proposed in cloud computing and compared QOS parameters like response time and resource utilization. The Load balancing algorithms can be static or dynamic.

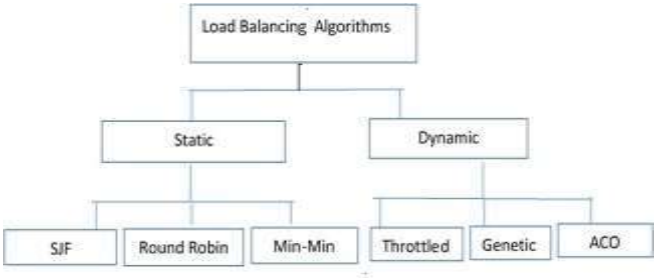

Fig.2 Load Balancing Algorithms

SJF: The main idea of the Modified Shortest Job First [1] is to sort the tasks in an ascending order based on the task length and calculate the average of all the tasks length. Then for all tasks the algorithm checks each task length, if it is less than the average tasks length and number of tasks in VM1 less than the number of tasks in VM2, then the task will be sent to VM1, else to VM2. It does not only focus on the completion time of the task but also takes into account the total completion time of all tasks.

Round Robin: Nithin Das K.C, Melvin S George and Jaya P [3] incorporated Weighted Round Robin algorithm in Honeybee algorithm in order to achieve minimum data center processing time and response time. For the tasks with priority, Honeybee Inspired algorithm is used by assigning weights to each virtual machine and the virtual machine is selected according to the resource requirement of the tasks. Tasks with no priority are executed using Weighted Round Robin algorithm. The proposed algorithm shows better results when compared with Weighted Round Robin and Honey bee Inspired load balancing algorithm.

Min-Min: Shyam Singh Rajput and Virendra Singh Kushwah [4] proposed Improved Load Balanced Min-Min (ILBMM) algorithm using genetic algorithm (GA) in order to minimize the make span and increase the utilization of resource. the execution time of task on the virtual machine was calculated then found the minimum or maximum time of task on virtual machine (VM), for better execution, genetic based approach is applied on million instructions (MI) of task and million instruction per second (MIPS) of VM. The results shows that the algorithm has minimized the make span compared to the existing LBMM algorithm.

Throttled: Soumi Ghosh Chandan Banerjee and Netaji Subhash proposed a modified priority based throttled algorithm [2] where The queue is used to hold the requests which are switched from execution state to wait state. The switching of task is done depending on the priority of the requested task. If the priority of the new request is greater than the priority of the executing request, then the executing request is switched by the new request and placed in Queue. If higher priority requests are served continuously, then the lower priority would never get a chance to be executed; i.e. it would suffer from starvation. To overcome this problem, priority of each waiting request is increased. If any of the Virtual Machine gets free, then it would check for new service request and the waiting request, then selects the job having highest priority and allocate VM to it. The Modified Priority Throttled Algorithm focuses mainly on the assignment of incoming jobs to the available virtual machines and distributed load uniformly among VMs depending on priority of the task, Results shows that resource utilization and response time has improved.

Genetic Algorithm: The Genetic Algorithm (GA) is an optimization algorithm which uses the method of computerized search based on natural selection and genetics.

ACO and Genetic Approach: Ashish Gupta and Ritu Garg[5] proposed an algorithm which is based on behavior of ant colonies for searching food and connecting with one another through pheromone trails that are left behind by ants on the paths they travel. In this paper, The ACO approach is used for scheduling independent tasks on the set of available resources with the aim to optimize makespan along with load balancing. Make span is the maximum completion time of all the tasks allotted to different machines. Ants construct solutions to scheduling problem during an iteration by moving from one VM to another until the tour is completed (i.e., until all tasks have been placed). Each mapped task onto a specific resource find pheromone and heuristic information and resource is picked up based on pheromone trails. For successive ants, initial pheromone values will be performed on updated pheromone values for previous ants. Local solutions for set of ants with makespan and load balancing level is obtained. Non dominated sort genetic algorithm is applied on multi-objective(minimize make span and load balancing) solutions to find the best local solutions. After every iteration, global solution is updated with pheromone matrix and best local solutions is generated. Procedure repeats and optimal solutions are found in the global solution after maximum number of iterations.

Elastic and flexible deadline constraint load balancing algorithm: Mohit Kumar, Kalka Dubey and S.C. Sharma,[6] proposed a cloud architecture that is capable of handling maximum user requests before meet the deadline and provides an elasticity mechanism with the help of threshold based trigger strategy. It calculate the number of tasks unable to meet deadline in each interval after that average of rejected task in last z interval is calculated and apply the user defined threshold conditions as per SLA.

If value of rejected tasks is more than or equal to the value of 30% of total tasks then 20% new VM will be added. If value of rejected list is more than 10% of total tasks then 10% new VM will be added. If rejected list is less than or equal to10% then there is no need to add the new VM. A VM is considered overloaded mode if they utilize their capacity more than or equal to 90% and under loaded if utilize their capacity less than 20%. Sorts VM in decreasing or increasing order based on overloaded or under loaded condition and transfer the task from overloaded node to under loaded node. If average of under loaded virtual machine is greater than the 30 % of all available virtual machine then decrease the virtual machine 20 % for next interval. If it is more than 10% then decrease the virtual machine 10% for next interval. Computational results shows that this algorithm reduce the make span time compared to FCFS, SJF and Min-Min algorithm.

Ant colony optimization (ACO) and Genetic Algorithm (GA) suffers from poor convergence speed. Whereas Particle swarm optimization has good speed due to velocity but limited to the initial set of particle problem. honeybee colony is improved further using the variance among the schedules[9]. Also, the multi objective fitness function is also designed to enhance the results further. The proposed technique initially schedules the jobs on high end servers and then try to balance the load between these high end servers.

III. VIRTUAL MACHINE MIGRATION

After scheduling the tasks, load balancing at run time will come in action [9]. Load balancing will migrate some jobs of heavily loaded high end servers (HESs) to under loaded HESs. Highest priority is given to jobs with minimum burst time. Scout bees are responsible for evaluating the over and under loaded HESs.

The Following Parameters must be considered while migrating a VM from one host to another host.

1. ***Total Migration Time:*** It indicates the time from the sender host enters migration process to time the destination host finishes it and starts working normally.

2. ***Network Traffic Reduction Percentage:*** The amount of data transfer saved because of the memory page compression and deduplication of it during live migration.

3. ***Downtime:*** The time duration up to which the VM is actually suspended to transfer CPU state as well as transfer WWS to the destination host.

4. ***Application Degradation***: It is the extent up to which live migration has slow down the application performance of migrating VM authorities.

Migration can take place at different levels

A. Process Migration: In process migration, process moves from one physical server to another physical server. In 1980's more research was done in process migration. However, due to residual dependency process migration didn't get popularity.

B. OS Migration: OS migration is another approach which handles all limitation of process migration and does the virtual machine migration efficiently. OS migration overcomes the residual dependency problem and administrator need not worry about it. Administrator can migrate OS and its associated process as single unit.

C. VM Migration: Migration requires that each memory state is stored consistently at application level state and kernel internal state on the target machine. This complete process degrades the cloud performance for a specific amount of time and may disappoint an active user. Even though this technique helps much in improving load balancing in cloud environment its downtime is the main negative effect.

Live migration keeps VM instances running during:

- Regular infrastructure maintenance and upgrades.
- Network and power grid maintenance in the data centers.
- Failed hardware such as memory, CPU, network interface cards, disks, power, and so on.. if a hardware fails completely or otherwise prevents live migration, the VM crashes and restarts automatically.
- Host OS and BIOS upgrades.
- Security-related updates, with the need to respond quickly.
- System configuration changes, including changing the size of the host root partition, for storage of the host image and packages.

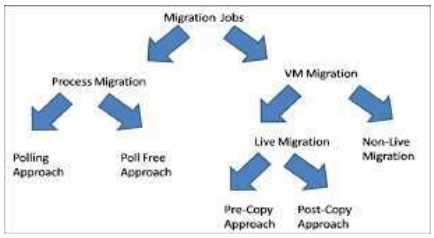

Fig.3 Types of Migration

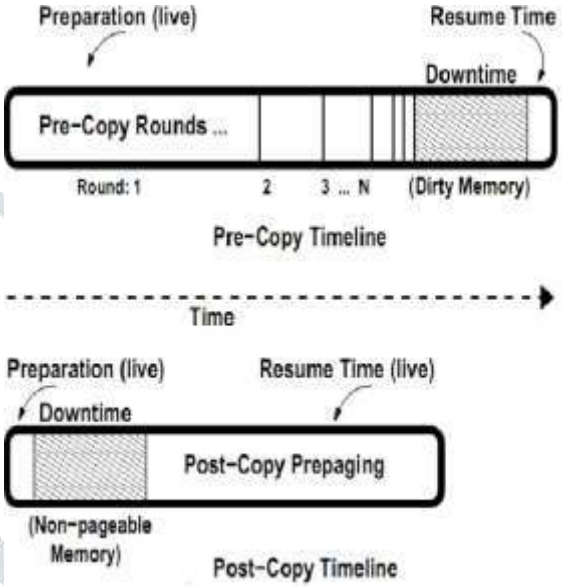

Fig.4 Migration Approaches

The migration approach can be

Pre Copy Approach: In this type of live migration, memory transfer phase starts with copying memory pages while the VM is running at the sender host. If in the i^{th} round a memory page is dirtied it is sent again to the destination host in i+1th round of page transfer. The Load of the destinatin host is calculated in each round. This iterative process continuous until the destination host overloaded.

***Post Copy Approach*:** Post copy live migration first copies sender processor state at source host and resumes the VM CPU state at the destination host. And after resuming VM at destination host, post copy live migration technique starts memory page transfer.

Security Issues of Live Migration

Live migration might be susceptible to range of attacks from Denial-of-Service (DoS) attacks to Man-In-The-Middle (MITM) attacks. During the migration, data can be tampered or sniffed easily as it is not encrypted. Thus compromising confidentiality and integrity of migrating data. These security threats in live VM migration discourages many sectors, such as financial, medical, and government from taking advantage of VM live migration. Hence, security is the critical challenge that needs examination to provide secure live VM migration.

A secure live migration of VM requires trusted source and destination platforms, authentication and authorization mechanism, confidentiality and integrity of migrated data, Mechanism to detect and notify suspicious activities. Open source hypervisors like VMware‘s (VMotion), Xen, KVM.Oracle‘s Virtual box etc supports live migration. Most of the hypervisors are performing live migration manually with a little or no consideration towards its security.

There are several security loop holes in live migration done by using KVM, Xen and VMware hypervisor. For Ex: VMware may expose the sensitive information during migration and the Xen can take advantage of vulnerability in migration module and hence can take complete control of VMM or host VM. Migration protocol used is not secure and does not encrypt migration data of VM. Hence, there is no confidentiality of migrated data, other vulnerabilities like untrusted platform, authentication, authorization

and bugs in hypervisor code etc..

Current techniques face many challenges while migrating memory and data intensive applications like network faults, changing the network connection type, and changing the virtual hardware compatibility. Consumption of network bandwidth and cloud resources are some of the attacks at cloud infrastructure level. Restrictions can be enabled to prevent users from removing virtual devices, changing the memory allocation, modifying fixed values of utilization thresholds. These are unsuitable for an environment with dynamic and unpredictable workloads, in which different types of applications can share a physical resource. The system should be able to automatically adjust its behavior depending on the workload patterns exhibited by the applications

a. The attacker may steal the bandwidth by taking control of the source virtual machine and migrating it to the destination virtual machine.

b. The attacker may falsely advertise its resource and attract others to migrate its resources towards itself.

c. Active manipulation: Attacker may modify the data which is travelling from the source to the destination.

d. Passive snooping: Attacker just accesses the data of migration using any sniffing tool that may lead to leakage of some confidential information.

Existing Security Controls

VM is encrypted with AES algorithm before migrated [10].VM can be accessed by the user if the authentication is provided so that security features like confidentiality, integrity and authentication is provided. VM is encrypted using AES algorithm using 256 bit key in Xor-Encrypt-Xor(XEX) bases tweaked codebook mode with cipher stealing (XTS) mode. Tweak value is a 128bit data used to represent the logical position, which may be encrypted or decrypted with XTS-AES. When the user tries to login, authorization is required. It is required to provide the password to decrypt the VM and launch VM to work upon it. It's difficult to gather the password by an unauthorized user. Only legitimate users are allowed to access and decrypt the VM image even after migration. The drawback of this approach is the VM has to be power down in order to encrypt it so it can't be live migration. The downtime may be increased.

Live cloud migration (LivCloud) [11] used the User Datagram Protocol based data transfer and KVM to enable nested virtualization on the cloud IaaS as well as securing the migration channel. To maintain encryption and authentication, LivCloud uses VPN, VPN is Amazon Virtual Network that helps building user-defined private network subnets inside the cloud in order to facilitate controlling IP address changes. This is able to provide encryption using Advanced Encryption Standard (AES) and authentication using Hash based Message Authentication Code (HMAC-SHA1. Optimization is needed to tackle the migration negative impact when live migrating between different hypervisors KVM and VMware and when VM disks are hosted on an NFS server.

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IV. PROBLEM FORMULATION

The VMs experience dynamic workloads in cloud, which means that the CPU usage by a VM arbitrarily varies over time. The host is oversubscribed, i.e., if all the VMs request their maximum allowed CPU performance, the total CPU demand will exceed the capacity of the CPU. When the demand of the CPU exceeds the available capacity, a violation of the SLAs established between the resource provider and customers occurs. To balance the load among cloud servers the migration of VM may take place.

The migration of VM can be categorized as follows based on the number of VMs to migrate.

Single VM migration problem- a single VM can be migrated out from the host. This migration leads to a decrease of the demand for the CPU performance and makes it lower than the CPU capacity.

Dynamic VM consolidation Problem- This is a more complex problem considering multiple hosts and multiple VMs. There are n homogeneous hosts are defined and the capacity of each host is A_h .VMs experience variable workloads, The maximum capacity that can be allocated to VM is A_v. Therefore, the maximum number of VMs allocated to a host when they demand their maximum CPU capacity is $m = A_h / A_v$. The total number of VMs is n_m. VMs can be migrated between hosts using live migration with a migration time t_m. An SLA violation occurs when the total demand for the CPU performance exceeds the available CPU capacity A_h. This host can be considered as overloaded host where there is a need of migrating a set of VMs from this host to another host (destination host) until The host is not being considered as overloaded.

After deciding the VMs to migrate, one more issue is to find the underutilized host or idle host as destination host so that load can be balanced and migrating a VM using appropriate security controls.

VM Security through Access Control Policy

Appropriate access control policies must be provided to secure the live VM migration process. An unauthorized user/role may launch VM initiate, migration operation. Unauthorized activities can be prevented by using access control list (ACL's). The Extended Access Control Markup Language (XACML) is used to apply access control policies to VM. XACML is an OASIS standard that describes both a policy language and a role based access control decision request/response language.

V. SYSTEM DESIGN and SIMULATION TOOLS

In Cloud Computing, The load balancing problem can be considered as multi objective NP-complete problem. The objectives may be efficient resource utilization, make span minimization, throughput maximization, etc. The proposed algorithm can be implemented using a cloud simulation tool cloudsim3.0 which facilitates to set up a cloud environment by implementing the Datacenter ,DatacenterBroker, Host, Vm and Cloudlet classes etc. different test cases will be evaluated and compare the results with existing algorithms. The algorithm starts with calculating load on each physical machine using following.

Load of a physical machine= Σ (capacity in MIPS) / Σ(assigned task length in MI)

The overloaded node (OLN) can be detected using algorithm1 selects the virtual machine"VM" from OLN and migrate it to under loaded node(ULN) based on either of the following policies

1. Migration time: The migration time can be calculated for each virtual machine then selects the VM which needs less amount of time to migrate so that the downtime can be improved.

2. Random Selection: The VM can be selected randomly so that each VM gets an equal opportunity and easy to apply this policy but this may not work efficiently as it is not considering any parameters for selection.

3. Memory Consumption: The virtual machine which occupies more memory can be selected to migrate so that the memory can be consumed efficiently by avoiding the memory overhead.

When migrating virtual machines from source host machine, access control policies can be used to protect virtual machine both at rest and in transit, just like any other data we store and transmit. secure policy is applied to the selected VM while migrating using algorithm2.

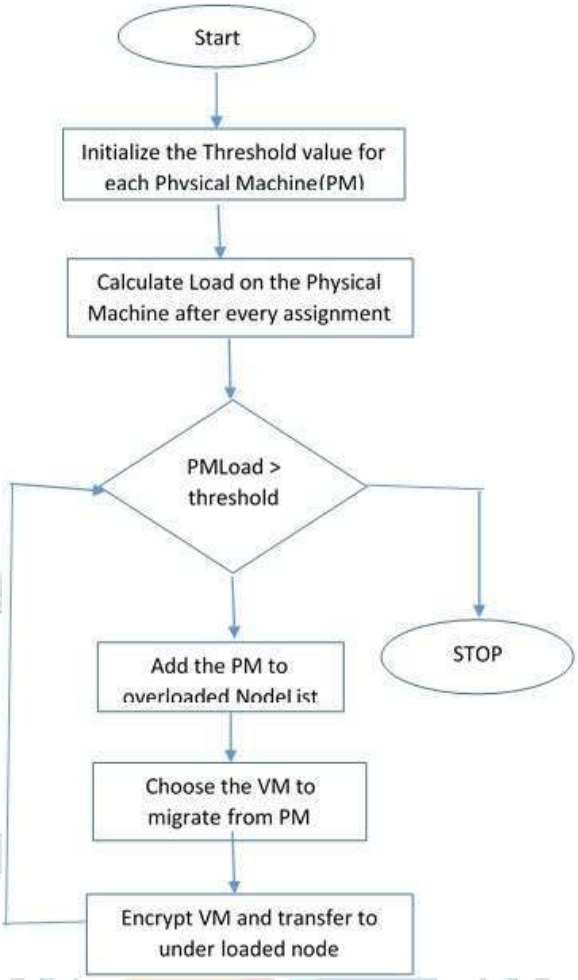

Fig.5 Flowchart

PROPOSED ALGORITHM

Algorithm 1 : Load Balancing using secure Live VM Migration
Input

VM List: Number of virtual machines
PMList: Number of Physical machines
Threshold(t): The Threshold value of each Physical Machine(PM) based on the total CPU consumption.

Output
Balanced Servers or Physical nodes in cloud

Procedure

repeat
1. Identify the overloaded host.
2. Select particular VMs to migrate from this overloaded host.
3. Apply the access control policies for VM using XACML(VM-XACML)
4. Migrate selected VM to another Host

until (host is considered as not overloaded)

Algorithm 2: Access control policies for VM using XACML(VM-XACML)

XACML suits for expressing access control policies to complex distributed resources with different user access rules that also may require domain based hierarchical user roles and permissions management. The XACML Role based access control policy provides extended functionality for managing user/subject roles and permissions by defining separate Permission <PolicySet>, Role <PolicySet>, Role Assignment <Policy>, and HasPrivilegeOfRole <Policy>.

The typical setup is that someone wants to take some action on a virtual machine, so the elements of request are user attributes, action and resource to be accessed The request/response language form a query to ask whether or not a given action should be allowed on the VM and interpret the result. The response always includes answer about whether the request should be allowed using one of four values: Permit, Deny, Indeterminate or Not Applicable. A sample of request and response can be shown as follows.

```
<Request>
 <Attributes>
  <Attribute AttributeId=”User1">
   <AttributeValue  DataType="http://www.w3.org/2001/XMLSchema#string">Jyothsna
   </AttributeValue>
 </Attribute>
</Attributes>
</Request>

<Response>
  <Result>
   <Decision>Permit</Decision>
    <Status>
     <StatusCode Value="urn:oasis:names:tc:xacml:1.0:status:ok"/>
    </Status>
 </Result>
</Response>
```

VI. CONCLUSION AND FUTURE WORK

Load balancing importance in cloud and its challenges, various load balancing algorithms, VM migration techniques and security issues in VM migration were reviewed in this paper and proposed a secure algorithm for VM migration and load balancing using XACML. The proposed algorithm tries to control the mentioned security issues while balancing the load using secure VM migration. The cloud servers are monitored regularly and tries to balance the load among them by the process of VM migration. The access policies must be defined to VM to avoid security issues. Planning to implement and test the proposed algorithm with various test cases in future.

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DETECTION OF REVIEW SPAM AND REVIEW SPAMMERS GROUP

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***Abstract*—** In the past few years, online reviews are hugely popular and crucial resource of customers' opinions. These reviews are useful for individual people to buy products and business organizations to take business decisions. But for the purpose of profits and to gain popularity some spam reviews will be given by fraudulent people. The fraudulent activities misinform certain customers and organizations remolding their businesses and forbid opinion-mining techniques from reaching exact conclusions. To detect the spam reviews, the recent time researches concentrate on systematically examining and also categorizing the models for detecting the spam reviews. In this paper, in order to solve spam reviews problem we will study some machine learning techniques that have been proposed and we will study the performance of different approaches for classification and detection of review spam. This paper major goal is to provide a solid and comparative study of today's research on detecting spam reviews and review spammers group using different machine learning techniques and Comparative summary of detecting spam reviews, and spam reviewers group detection techniques.

***Keywords*—** Supervised learning, unsupervised learning

I. INTRODUCTION

As the Internet continues to grow in both size and importance, the quantity and impact of online reviews continually increases. Reviews have power to influence individuals across abroad range of industries, but are majorly important in the region of ecommerce, where comments and reviews related to products and also services are the highly convenient, if not the only, way for a purchaser to take a decision on whether or not to purchase them. Online reviews are written for a variety of reasons. Often, in an effort to improve and enhance their businesses, online retailers and service providers sometimes request their customers to give feedback about their experience regarding the products or services they have purchased and asks if they were satisfied about the product or not. Customers may also feel that it's better to give review on a product or service if they had a good or bad or worst experience with the product.

While reviews on online can be helpful, but blind trust of these reviews is dangerous for both the seller and buyer. A lot of people wanted to read online reviews before placing any order on online. The reviews may be false hyped or faked for profit or gain. Hence we have to be careful before we take any decision by reading online reviews.

Furthermore, business owners will give money to the persons who writes good reviews about their own commodities and also they encourage the reviewers to write bad reviews about others products or services. These reviews are considered spam reviews. These reviews can have a huge impact in online marketing areas.

In 2011 NirKshetri et al. [1] discovered the illegal and unethical practices and cybercrimes in social media. Then in 2013 Marco Huesch ,Greg VerSteeg et al.[2] identified vulnerabilities in social media content and they explored Manipulation of public opinion identified to detect bad practices over social media.

Similarly in 2017 Summer Lightfoot et al [3] provides useful insight about false propaganda (fake reviews) over social networks.

II. KINDS OF SPAM REVIEW (OPINION SPAM)

According to Dixit et al. [4] opinion spams categorized into three groups. They are Untruthful reviews, Reviews on brands only, Non-reviews.

Untruthful reviews: Also called fake or bogus reviews, these are very virulent and their purpose is to intentionally misguide readers or customers or automated systems by reading false positive or false negative reviews about a product or service.

Reviews on brands only: These reviews do not contain specific product or service reviews but these reviews for brands, manufacturers, or sellers.

Non-reviews: These are not actual reviews or opinions. They may be advertisement or other irrelevant text which contain no opinion.

III. FEATURE ENGINEERING FOR DETECTING SPAM REVIEWS

It is important to specify that while a lot of existing

techniques of machine learning are not enough effective for detecting spam reviews, they can have been discovered to be more reliable than manual detection. These issues are identified by Abbasi et al. [5], is the lack of any differentiating words or features that gave a definitive clue for classification of reviews as actual or fake. A general approach in text mining is to use a set of words approach where the presence of word, or small unit of words are used as features. Many of the studies found that the above mentioned approach is not sufficient to train a classifier with enough performance in detecting spam reviews.

Therefore, additional methods of feature engineering must be examined in an effort to extract an additional informative feature set that will improve spam review detection. Types of Feature's used in detection of spam reviews:

1) Linguistic features (or) Review centric features: - Review centric features are features that are constructed using information comprised in a single review. Categories in this feature are:

i) Bag of words: In a bag of words approach, individual or small groups of words from the text are used as features, are called as n-grams. These are made by choosing n continuous words from a given sequence. That means selecting 1, 2 or 3 contiguous words from a text. They are denoted as a uni-gram, bi-gram, and tri-gram (n = 1, 2 and 3) respectively.

ii) Term frequency: These features are similar to bag of words however, instead of simply being concerned with the existence or non-existence of a term; it concerns the frequency with which a term occurs in each review, so we include the count of occurrences of a term in the review.

iii) Part of Speech (POS) tagging: It involves tagging word features with a part of speech based on the definition and its circumstances within the sentence in which it is found.

iv) Word Count (WC): It is a text analysis software tool in which users can build their own dictionaries to study dimensions of language especially their points of interest.

v) Stylometric features: These features are either character and word based lexical features or syntactic features. Lexical features gives suggestion of the types of words and characters that the writer wishes to use and includes features such as average word length or the number of upper case characters. Syntactic features try to represent the reviewer's writing style and include features such as the amount of punctuation words such as "a", "the", and "of".

vi) Semantic features: These features address the underlying meaning of the words used to make semantic language models for detecting fake reviews.

vii) Review characteristic or metadata: These features contain metadata (information about the reviews) rather than information on the text content of the review. These characteristics could be the review's length, date, time, rating, reviewer id, review id, store id or feedback.

2) Behavioral features (or) Reviewer centric features: - These will take a holistic look at all of the reviews written by any particular author, along with information about the particular author.

i) Maximum number of reviews: It was found that about 75 % of spammers write more than 5 reviews on any given day. Therefore, taking into account the number of reviews a user writes per day can help detect spammers.

ii) Percentage of positive reviews: Approximately 85 % of spammers wrote more than 80 % of their reviews as positive reviews, thus a high percentage of positive reviews might be an indication of an untrustworthy reviewer.

iii) Review length: The average review length is a very significant aspect of reviewers with suspicious intentions since about 80 % of spammers won't write reviews more than 135 words.

iv) Reviewer deviation: It was analyzed that ratings of spammers tend to vary from the average review rating at a far higher than the rate of legitimate reviewers, therefore identifying user rating variations might be helpful in detection of dishonest reviewers.

v) Maximum content similarity: The presence of like reviews for many different products or goods by the same reviewer has been known to be an indication of a spammer.

3) Information about the product: - Information about a product is useful in spam detection such as, the product description and sales volume, information about merchandise being reviewed as average ratings, number of reviews, product description, popularity and sales volume. For example, a product with many positive reviews but low sales calls the reliability of the positive reviews into question.

IV. SPAM OR FAKE REVIEW DETECTION USING MACHINE LEARNING TECHNIQUES

In this paper we discuss machine learning techniques that have been proposed for the detection of online spam review with an emphasis on feature engineering. The identification of opinion spam has become a huge concern

in today's times to authenticate online reviews and gain consumer faith, trust and confidence.

Detection types: -

Review centric spam review detection.
Reviewer centric review spam detection.

1) Review centric review spam detection: -

It is the most usual form of review spam detection, which uses machine learning techniques to develop models using the content and metadata of the reviews. Supervised learning is the task of learning from labelled data and it is the most frequent method used for review spam detection in the literature. This method requires labeled information or data in order to train a classifier, on the other hand, unsupervised learning uses unlabeled data to find unseen relationships between instances independent of a class attribute, Semi-supervised learning is a combination of both supervised and unsupervised learning, which uses a few labeled instances in combination with a large number of unlabeled instances to train a classifier.

1) Supervised learning: - Supervised learning can be used to find review spam by looking at it as the classification problem of separating reviews into two classes: spam and non-spam reviews. Initially Jindal et al [6] discussed the progression of opinion mining, they found that opinion spam is totally different from email and Web spams.

He primarily focused on summarizing extracting or the opinions from text by using Natural Language Processing (NLP). Next Jindal et al collected millions of reviews on products from amazon, categorized reviews and identified spam reviews using near duplicate reviews method. Raymond et al. [7] identified another set of features from reviews and used logistic regression model to identify fake reviews. Raymond et al. got AUC score of 0.78 was achieved when using all features, compared to an AUC score of 0.63 when only using text features. Ottet al.[8] produced dataset using Amazon Mechanical Turk (AMT) in combination with Trip Advisor.

For this work, three groups of features were identified: POS tag frequencies, WC, and bigram for text categorization based features. Naïve Bayes and SVM classifiers were trained and evaluated, their best model achieved an accuracy of 89.8 % using bigram and WC features with an SVM classifier. Li et al.[9] created a cross domain dataset that included three types of reviews from three domains (hotel, restaurant and doctor).

His classification framework was based on using the Sparse Additive Generative Model (SAGE), which is a generative Bayesian approach. Shojaee et al.[10] proposed a novel method for detecting review spam by using Stylometric (Lexical and Syntactic) features. In this work they developed classifiers on the dataset created by Ott et al.They observed that the hybrid feature set using the SVM learner achieved the highest performance, an F-measure of 84 %.

2. Unsupervised Learning: - The use of supervised learning method are not applicable Because of the difficulty of constructing accurately labeled datasets of review spam. It provides a solution for this because it doesn't need labeled data.

A novel unsupervised text mining models are developed and combined into a semantic language model for identifying false reviews by Raymond et al.[7] and this work compared with supervised learning methods.

An unsupervised method proposed by Wu et al. (2010) [11] shows the effect of distortion in distinguishing positive singleton spam reviews from positive singleton real reviews on a dataset of hotel reviews.

A novel generative model called Latent Spam Model (LSM) [2014] [12] for spam review detection using unsupervised learning developed by Arjun Mukherjee et.

3) Semi-supervised learning: - In other domains, it has been discovered that utilizing unlabeled data in addition with a little amount of labeled data can gradually improve learner accuracy as compared to completely supervised methods. In a study by Li et al.,[13] a two-view semi supervised method for review spam detection was created by employing the framework of a co-training algorithm to make use of the large amount of unlabeled reviews available. PU-Learning is another type of semi-supervised learning approach, developed by Liu et al.The model is prepared and evaluated utilizing all of the unlabeled data as the negative class and any instances that are classified as positive are removed.

2) Reviewer centric review spam detection:-

Identifying reviewers who are creating fake reviews are given importance in the effort to detect spam reviews. Using reviewer centric features in collaboration with review centric features might be chosen over a review centric only approach for detecting spams.

Additionally, collecting behavioral proofs of spammers is easier than recognizing spam reviews. Mukherjee et al. study of supervised learning approaches for deceptive review detection observed that using behavioral features yields higher performance than linguistic features alone on the real world Yelp dataset. Behavioral features (i.e., higher percentage of positive reviews, high number of reviews, average review length).

V. GROUP SPAM REVIEWERS DETECTION

Occasionally, spamming activities can be considered the events of group spamming; manufacturers hires more spammers to do a task because they can have ability to dominate all aspects, features and opinions for a product or brand. On another times, the persons will work together geographically and they are in contact with each other. This process will increase their abilities, power and cooperation at the time of attacks.

Various behaviors of spamming can be extracted from groups of spammers. These are used to classify spam groups from individual reviewers. The features used in group spam detection in Mukherjee et al. (2012) [14] are called spam indicators.

Features used to find group spammers:

1. Number of reviews within a time interval
2. Deviations between the average ratings of a product and the ratings given by members of the group.
3. Content similarity between members;
4. Content similarity among a group;
5. Group early time frame
6. Group size.
7. Group size ratio,
8. Group support count:
9. Individual Member Coupling

In the previous works of group spammers detection Mukherjee et al. [2012] proposed GRank as a relational model used as relationships between individual and group indicators and target products to rank candidate groups as spam or non-spam groups using supervised learning.

Zhuo Wang [2015] [15] proposed a Review Spammer Groups via Bipartite Graph Projection, which is loose spammer group detection problem and he obtained good precision and recall compared to frequent item set mining (FIM) FIM-based approach. LU ZHANG [2017] [16] propose a partially supervised learning model (PSGD) to detect spammer groups.

PSGD applied PU-Learning to study a classier as spammer group detector from positive instances (labeled spammer groups) and unlabeled instances (unlabeled groups). Experiments on Amazon.cn data set shows that the proposed method is effective compared to the state-of-the-art spammer group detection methods (Naive Bayesian model and an EM algorithm).

VI) COMPARATIVE SUMMARY OF REVIEW SPAM DETECTION, SPAM REVIEWERS GROUP DETECTION TECHNIQUES

Table 6.1: Summary for spam review detection techniques

Author	Title	Year	Journal	Data set(s) used	Performance Metric
Kyumin Lee, James	Detecting Collective Attention Spam	2012	ACM	Twitter dataset	Accuracy, false positive rate and false negative rate and total spam detection
Xia Hu, Jiliang Tang,	Social Spammer Detection with Sentiment Information	2014	IEEE	Twitter dataset	Precision, recall, and F1-measure
Kristin Kinmont	Fake News Detection in Twitter	2014	IEEE	Twitter data	Truthy, TweetCred and Cognos.
Yuqing Lu, Lei Zhang	Simultaneously Detecting Fake Reviews and Review Spammers using Factor Graph Model	2013	ACM	Amazon Dataset	average F1 and Accuracy
Arjun Mukherjee Vivek Venkataramn	Opinion Spam Detection: An Unsupervised Approach using Generative Models	2014	Semantic Scholar	AMT Dataset, Amazon Dataset, Yelp Restaurants	precision, recall, and F1-score
Shebuti Rayana Leman Akoglu	Collective Opinion Spam Detection: Bridging Review Networks and Metadata	2015	ACM	Yelp.com	AP and AUC
JITENDRA KUMAR ROUT	Revisiting Semi-Supervised Learning for Online Deceptive Review Detection	2017	IEEE	Gold standard dataset by Ott et al.	Accuracy, precision, Recall, F-score

Saeedreza Shehnepoor, Mostafa	NetSpam: a Network-based Spam Detection Framework for Reviews in Online Social Media	2017	IEEE JOURNAL	Yelp dataset	AP and AUC
Dilsha, lijo	Opinion Spam Setection using Review, Reviewer Centric features	2017	IEEE	food product data set	F-Score
Man-Chun Ko,	Paid Review and Paid Writer Detection	2017	ACM	restaurant reviews from Pixnet	Precision, Recall, F1
Huaxun Deng, Linfeng Zhao	Semi-supervised Learning based Fake Review Detection	2017	IEEE	crawled from JD.com	Accuracy
Wael Etaiwi, Arafat Awajan	The Effects of Features Selection Methods on Spam Review Detection Performance	2017	IEEE	`gold standard' dataset by Ott et al.	Precision, Recall, Accuracy
Simran Bajaj, Niharika Garg	A Novel User-based Spam Review Detection	2017	Elsevier	own dataset	Accuracy
Draško Radovanovi	Review Spam Detection using Machine Learning	2018	IEEE	Akismet	Accuracy
Arjun Mukherjee, Bing Liu	Detecting Group Review Spam	2011	ACM	Amazon Dataset	Avg Number of detected spam groups
Arjun Mukherjee Bing Liu, Natalie Glance	Spotting Fake Reviewer Groups in Consumer Reviews	2012	ACM	Amazon Dataset	AUC (Area Under the ROC Curve)
Zhuo Wang, Tingting Hou, Dawei Song	Detecting Review Spammer Groups via Bipartite Graph Projection	2015	British Computer Society	amazon review dataset	Precision, recall and F1, Number of k-connectivity spam groups
Zhuo Wang · Songmin Gu · Xiangnan Zhao	Graph-based review spammer group detection	2017	Springer	amezon yelp.com	Precision, Recall and F1-Score
LU ZHANG , ZHIANG WU,	Detecting Spammer Groups From Product Reviews: A Partially Supervised Learning Model	2017	IEEE	Amazon.cn	Precision, Recall and F1-Score

VII. CONCLUSION

To understand the trends for detecting spam reviews and future directions for researchers on review spam detection, in our study we provided different types of features and two main approaches used for review and reviewers spam detection. Along with them this survey provided metrics used to find group spammers in opinion spam reviewer's detection which is a broad future work in this area. This survey also provided summary table for spam review and reviewers detection which contains previous work done by researchers in this area and provided their performance metrics. As per detected gaps in literature survey, future work will be extracting the most effective features from reviews and reviewers to find spam reviews using unsupervised learning method which uses unlabeled data or raw data and to increase the accuracy of detection because most of the previous works are developed on supervised method on labeled data for detection.

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Career Development Centre

Internship Offers Through Campus Recruiting Companies List 2018-19

Sl.No.	Name	Roll number	Branch	Year	Company	Stipend
1	Nagarjun Reddy Gurram	160115733037	CSE -1	4th Year	Accenture	15,000
2	GouthamiReddy Gidde	160115733305	CSE -1	4th Year	Accenture	15,000
3	Sai Lakshmi Keerthana Vogireddy	160115733011	CSE -1	4th Year	Accenture	15,000
4	Saivikhyath Chelamela	160115733052	CSE -1	4th Year	Accenture	15,000
5	Prasanna Danappagari	160115733308	CSE -1	4th Year	Accenture	15,000
6	Bhavya Guduru	160115733066	CSE -2	4th Year	Accenture	15,000
7	Rohith Reddy Singireddy	160115733104	CSE -2	4th Year	Accenture	15,000
8	Sushanth Samala	160115733115	CSE -2	4th Year	Accenture	15,000
9	Karthik Kedam	160115733089	CSE -2	4th Year	Accenture	15,000
10	Varun Kashyap	160115733090	CSE -2	4th Year	Accenture	15,000
11	Srikanth Karrre	160115733314	CSE -2	4th Year	Accenture	15,000
12	Kavyasree Karingla	160115733335	CSE -3	4th Year	Accenture	15,000
13	Gayatri Tawada	160115733124	CSE -3	4th Year	Accenture	15,000
14	Madhurima Yella	160115733131	CSE -3	4th Year	Accenture	15,000
15	Lakshman Amireddy	160115733158	CSE -3	4th Year	Accenture	15,000
16	Himanshu Ketan Kapashi	160115733157	CSE -3	4th Year	Accenture	15,000
17	Mehraj mohammed	160115733328	CSE -3	4th Year	Accenture	15,000
18	Katamoni Sreerupa	160115733310	CSE-1	4th Year	Accenture	15,000
19	MD Asif Ali	160115733094	CSE-2	4th Year	Accenture	15,000
20	Pranay Gaini	160115733161	CSE-3	4th Year	Accenture	15,000
21	KamalVamsi Mesa	160115735042	ECE-1	4th Year	Accenture	15,000
22	Anirudh Kodavatiganti	160115735036	ECE-1	4th Year	Accenture	15,000
23	Usharani Pathlavath	160115735029	ECE-1	4th Year	Accenture	15,000
24	Madhuri Kandi	160115735013	ECE-1	4th Year	Accenture	15,000
25	Vivek Kodepaka	160115735060	ECE-1	4th Year	Accenture	15,000
26	Ranjith Boorugula	160114735045	ECE-1	4th Year	Accenture	15,000
27	Harini Kolloju	160115735009	ECE-1	4th Year	Accenture	15,000
28	Arun Kumar Allam	160115735037	ECE-1	4th Year	Accenture	15,000
29	Apeksha Khairtabad	160115735002	ECE-1	4th Year	Accenture	15,000
30	Pavan Kumar Boorla	160115735307	ECE-1	4th Year	Accenture	15,000
31	Bhanu prakash Renikuntla	160115735089	ECE-2	4th Year	Accenture	15,000
32	Rajashekar Reddy Minipuri	160115735314	ECE-2	4th Year	Accenture	15,000
33	Bindu Devalla	160115735065	ECE-2	4th Year	Accenture	15,000
34	Saikumar Gajji	160115735110	ECE-2	4th Year	Accenture	15,000
35	Monika Satla	160115735068	ECE-2	4th Year	Accenture	15,000
36	Srikanth Naradasu	160115735105	ECE-2	4th Year	Accenture	15,000

37	Rahul Devunuri	160115735103	ECE-2	4th Year	Accenture	15,000
38	Ruchitha Ambothu	160115735073	ECE-2	4th Year	Accenture	15,000
39	Roshini Bijjala	160115735072	ECE-2	4th Year	Accenture	15,000
40	Suresh Kumar Begari	160115735173	ECE-3	4th Year	Accenture	15,000
41	Bhanu Challa	160115735143	ECE-3	4th Year	Accenture	15,000
42	Kasarla Sai Pratheek Reddy	160115735167	ECE-3	4th Year	Accenture	15,000
43	Mounika Amgoth	160115735128	ECE-3	4th Year	Accenture	15,000
44	Karthik reddy Gaddam	160115735146	ECE-3	4th Year	Accenture	15,000
45	Sujan Kumar Vasimalla	160115735171	ECE-3	4th Year	Accenture	15,000
46	Sabavath Janardhan	160115735335	ECE-3	4th Year	Accenture	15,000
47	Shiva shanth reddy Gurrala	160115735169	ECE-3	4th Year	Accenture	15,000
48	Arvind Keesara	160115735330	ECE-3	4th Year	Accenture	15,000
49	Varshitha Indukuri	160115735139	ECE-3	4th Year	Accenture	15,000
50	ADITYA Navuduri	160115734025	EEE-1	4th Year	Accenture	15,000
51	NITHYA REDDY Katepally	160115734010	EEE-1	4th Year	Accenture	15,000
52	TARUN SAI Potluri	160115734054	EEE-1	4th Year	Accenture	15,000
53	SHASHIDHAR MAMIDIPELLI	160115734051	EEE-1	4th Year	Accenture	15,000
54	SAI VAMSHI Akula	160114734046	EEE-1	4th Year	Accenture	15,000
55	Revanth Varma	160115734043	EEE-1	4th Year	Accenture	15,000
56	SAI CHARAN Pobbati	160115734045	EEE-1	4th Year	Accenture	15,000
57	VAISHNAVI Badhe	160115734023	EEE-1	4th Year	Accenture	15,000
58	SAI SURYA Indraganti	160114734045	EEE-1	4th Year	Accenture	15,000
59	Rahul Thandu	160115734041	EEE-1	4th Year	Accenture	15,000
60	PRITHVEESH Lingala	160115734039	EEE-1	4th Year	Accenture	15,000
61	SPOORTHY MUDDASANI	160115734016	EEE-1	4th Year	Accenture	15,000
62	Anukriti Singh	160115734001	EEE-1	4th Year	Accenture	15,000
63	KALPANA VALLAPUREDDY	160115734008	EEE-1	4th Year	Accenture	15,000
64	JULURI Ravikiran	160115734306	EEE-1	4th Year	Accenture	15,000
65	Jai Anusha Duggirala	160115734066	EEE-2	4th Year	Accenture	15,000
66	Sai vivek reddy Yedulla	160115734106	EEE-2	4th Year	Accenture	15,000
67	Sumegha Reddy Avula	160114734079	EEE-2	4th Year	Accenture	15,000
68	Sai Alekhya Datla	160115734072	EEE-2	4th Year	Accenture	15,000
69	Joel Vinod Singavarapu	160115734088	EEE-2	4th Year	Accenture	15,000
70	Divya Sai Nemmani	160115734064	EEE-2	4th Year	Accenture	15,000
71	Sirisha Kethavath	160115734078	EEE-2	4th Year	Accenture	15,000
72	Jahnavi Thotakura	160115734065	EEE-2	4th Year	Accenture	15,000
73	Premsagar Cheviti	160115734097	EEE-2	4th Year	Accenture	15,000
74	Amena Nousheen	160115734324	EEE-2	4th Year	Accenture	15,000
75	Javeed Meandad	160115734091	EEE-2	4th Year	Accenture	15,000
76	Supriya Chintala	160115734321	EEE-2	4th Year	Accenture	15,000
77	Soumya Dudka	160115734319	EEE-2	4th Year	Accenture	15,000

78	Shravani Bandikatla	160115734076	EEE-2	4th Year	Accenture	15,000
79	Swapna Gajjala	160114734082	EEE-2	4th Year	Accenture	15,000
80	Deepika Nadakuditi	160115734063	EEE-2	4th Year	Accenture	15,000
81	Geetha Julakanti	160115737011	IT -1	4th Year	Accenture	15,000
82	Ujwal Dasari	160115737056	IT -1	4th Year	Accenture	15,000
83	Srujan Tikayyolla	160115737055	IT -1	4th Year	Accenture	15,000
84	Madhuri Kurri	160115737016	IT -1	4th Year	Accenture	15,000
85	Satvika Yenigalla	160115737026	IT -1	4th Year	Accenture	15,000
86	Sonali Bandi	160115737029	IT -1	4th Year	Accenture	15,000
87	Aparna Reddy	160115737005	IT -1	4th Year	Accenture	15,000
88	Pavan Raj Gajarla	160115737046	IT -1	4th Year	Accenture	15,000
89	Jatin Lingala	160115737097	IT -2	4th Year	Accenture	15,000
90	Manish Enishetty	160115737099	IT -2	4th Year	Accenture	15,000
91	Krishna Teja Jamalapuram	160115737098	IT -2	4th Year	Accenture	15,000
92	Sai sandesh Goud Sunkishala	160115737110	IT -2	4th Year	Accenture	15,000
93	Abhinav Raju Nadimpally	160115737085	IT -2	4th Year	Accenture	15,000
94	Roshini Palle	160115737070	IT -2	4th Year	Accenture	15,000
95	Indrani Budigam	160115737065	IT -2	4th Year	Accenture	15,000
96	Rishi Chandana Chinthareddy	160115737069	IT -2	4th Year	Accenture	15,000
97	M SRINU NAIK	160115737114	IT-2	4th Year	Accenture	15,000
98	Sadeep Gurram	160115737314	IT-2	4th Year	Accenture	15,000
99	Harsha Vardhan Sankineni	160115733326	CSE	4th Year	Accolite	20,000
100	Madhukar Domakonda	160115733159	CSE	4th Year	Accolite	20,000
101	Matha Dileep	160115733153	CSE	4th Year	Accolite	20,000
102	Sai Deepa Bhavani Peri	160115737071	IT	4th Year	Accolite	20,000
103	Prathik Saxena	160115737102	IT	4th Year	Accolite	20,000
104	P Sai Kranti	160115737106	IT	4th Year	Accolite	20,000
105	M.Sri Manika	160115735079	ECE	4th Year	Alog Tech	8,000
106	Bhavesh Raja	160115805041	Bio-Tech	4th Year	Byju's	25,000
107	Aditya Kante	160115737033	IT	4th Year	Byju's	25,000
108	Bezawada Chiranjeevi	160115736081	Mech-2	4th Year	Byju's	25,000
109	Pavan Tarun	160115738034	Prod	4th Year	Byju's	25,000
110	M KRISHNAKANTH VASISTA	160115805053	Bio-Tech	4th Year	Capgemini	Yet to be decided
111	Kurapati Manideepika	160115802007	Chemical	4th Year	Capgemini	Yet to be decided
112	Dinesh Chowdary G	160115733154	CSE	4th Year	Capgemini	Yet to be decided
113	Rachana Kavukuntla	160115733134	CSE	4th Year	Capgemini	Yet to be decided
114	Samrat Bingi	160115733168	CSE	4th Year	Capgemini	Yet to be decided
115	Madhuri Vennu	160115733130	CSE	4th Year	Capgemini	Yet to be decided
116	Divya K	160115733069	CSE	4th Year	Capgemini	Yet to be decided
117	Meghana	160115733327	CSE	4th Year	Capgemini	Yet to be decided
118	KOPPULA GANESH	160115735332	ECE	4th Year	Capgemini	Yet to be decided

119	Mohammad Mansoor	160115735098	ECE	4th Year	Capgemini	Yet to be decided
120	Koppaka Sai Sri Chandana	160115735133	ECE	4th Year	Capgemini	Yet to be decided
121	Harshitha Ambilpur	160115735010	ECE	4th Year	Capgemini	Yet to be decided
122	T KAUSHAL	160115735043	ECE	4th Year	Capgemini	Yet to be decided
123	Tadi Pavan Kumar	160115735048	ECE	4th Year	Capgemini	Yet to be decided
124	Morampudi Uday	160115735059	ECE	4th Year	Capgemini	Yet to be decided
125	E.Radhika	160115735313	ECE	4th Year	Capgemini	Yet to be decided
126	MOHAMMAD NOMAN JUNAID	160115735148	ECE	4th Year	Capgemini	Yet to be decided
127	T. Lakshmi Deepika	160115735125	ECE	4th Year	Capgemini	Yet to be decided
128	Vishnu Pasula	160115734060	EEE	4th Year	Capgemini	Yet to be decided
129	Hari Charan Reddy V	160115734030	EEE	4th Year	Capgemini	Yet to be decided
130	M VAMSHI KRISHNA REDDY	160115734057	EEE	4th Year	Capgemini	Yet to be decided
131	Pranathi Reddy Mula	160115734011	EEE	4th Year	Capgemini	Yet to be decided
132	Kadevari Rohith	160115737049	IT	4th Year	Capgemini	Yet to be decided
133	Ashritha Polneni	160115737007	IT	4th Year	Capgemini	Yet to be decided
134	BhargavReddy Muthukuru	160115737094	IT	4th Year	Capgemini	Yet to be decided
135	Aditya Kante	160115737033	IT	4th Year	Capgemini	Yet to be decided
136	Sai Vivek Yeggadi	160115737109	IT	4th Year	Capgemini	Yet to be decided
137	Navya Gunti	160115736006	Mechanical	4th Year	Capgemini	Yet to be decided
138	Krishna sai vadapally	160115736089	Mechanical	4th Year	Capgemini	Yet to be decided
139	K Vihar	160115733178	CSE	4th Year	Caravel. AI	25,000
140	Rishi Vishwanadhan	160115805050	Bio-Tech	4th Year	CCMB	30,000
141	Mani Deepika Mallavarapu	160115805010	Bio-Tech	4th Year	CCMB	25,000
142	Himanshu Ketan Kapashi	160115733157	CSE -3	4th Year	Code Mani Green Tech Solutions	16.500
143	Rizwana Shaik	160115805030	BIO-Tech	4th Year	Cognizant	12,000
144	Tirumalasetty Vijay	160115802050	Chemical	4th Year	Cognizant	12,000
145	Akhil Konegari	160115732084	Civil	4th Year	Cognizant	12,000
146	Kolishetty Mahesh	160115732095	Civil	4th Year	Cognizant	12,000
147	Pallavi Byagari	160115733008	CSE	4th Year	Cognizant	12,000
148	Akhila Sirikonda	160115733001	CSE	4th Year	Cognizant	12,000
149	Keerthi Sanke	160115733004	CSE	4th Year	Cognizant	12,000
150	Monica K.	160115733006	CSE	4th Year	Cognizant	12,000
151	Shambhavi M	160115733014	CSE	4th Year	Cognizant	12,000
152	Shreya Therupally	160115733016	CSE	4th Year	Cognizant	12,000
153	Aravind Babu Somarapu	160115733023	CSE	4th Year	Cognizant	12,000
154	Hari Challa	160115733029	CSE	4th Year	Cognizant	12,000
155	Hemanth Reddy	160115733031	CSE	4th Year	Cognizant	12,000
156	Ithesh Muppaneni	160115733032	CSE	4th Year	Cognizant	12,000
157	Sai Allala	160115733049	CSE	4th Year	Cognizant	12,000
158	SRINATH TANGALLAPALLY	160115733056	CSE	4th Year	Cognizant	12,000
159	SRUJANVESH GOUD KOTHA	160115733057	CSE	4th Year	Cognizant	12,000

160	Aakanksha Vinnakoti	160115733061	CSE	4th Year	Cognizant	12,000
161	Thota Jyothi	160115733070	CSE	4th Year	Cognizant	12,000
162	shefali shireen	160115733075	CSE	4th Year	Cognizant	12,000
163	ABRAR ATHAR HASHMI	160115733082	CSE	4th Year	Cognizant	12,000
164	Harish Kumar Kathi	160115733087	CSE	4th Year	Cognizant	12,000
165	Praneeth Kumar Sajulu	160115733099	CSE	4th Year	Cognizant	12,000
166	Alekya Gujjala	160115733121	CSE	4th Year	Cognizant	12,000
167	Komal Puranik	160115733127	CSE	4th Year	Cognizant	12,000
168	Rachana Kavukuntla	160115733134	CSE	4th Year	Cognizant	12,000
169	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	Cognizant	12,000
170	Dileep Matha	160115733153	CSE	4th Year	Cognizant	12,000
171	Madhukar Domakonda	160115733159	CSE	4th Year	Cognizant	12,000
172	Uma Maheshwara Swamy D	160115733177	CSE	4th Year	Cognizant	12,000
173	Sharon Keerthana Chiluvuri	160115735021	ECE	4th Year	Cognizant	12,000
174	Suchithra Reddy Yellolu	160115735026	ECE	4th Year	Cognizant	12,000
175	Supraja Paloju	160115735027	ECE	4th Year	Cognizant	12,000
176	Abhilash Reddy Devarinti	160115735033	ECE	4th Year	Cognizant	12,000
177	Anil kumar	160115735035	ECE	4th Year	Cognizant	12,000
178	Raghuram Chepuri	160115735049	ECE	4th Year	Cognizant	12,000
179	Sarparapu Divya Sri	160115735066	ECE	4th Year	Cognizant	12,000
180	Goutham Sadubathula	160115735092	ECE	4th Year	Cognizant	12,000
181	Methuku Mohan Kumar	160115735099	ECE	4th Year	Cognizant	12,000
182	Liji p Jose	160115735126	ECE	4th Year	Cognizant	12,000
183	Poojitha Borra	160115735129	ECE	4th Year	Cognizant	12,000
184	baswa sairama amulya	160115735134	ECE	4th Year	Cognizant	12,000
185	K Sampangi Tejaswini	160115735135	ECE	4th Year	Cognizant	12,000
186	Ulligadda sreeja	160115735137	ECE	4th Year	Cognizant	12,000
187	Amit Anchaliya	160115735142	ECE	4th Year	Cognizant	12,000
188	Nikhil Madhunala	160115735152	ECE	4th Year	Cognizant	12,000
189	Latha Gunja	160115735322	ECE	4th Year	Cognizant	12,000
190	BHAGYA SRI G	160115734003	EEE	4th Year	Cognizant	12,000
191	HARITHA RACHURI	160115734005	EEE	4th Year	Cognizant	12,000
192	SHIVAPRIYA CHADA	160115734014	EEE	4th Year	Cognizant	12,000
193	SRINIJA REDDY KAMATHAM	160115734018	EEE	4th Year	Cognizant	12,000
194	VAISHNAVI AVADHANAM	160115734022	EEE	4th Year	Cognizant	12,000
195	AKASH GUNTI	160115734026	EEE	4th Year	Cognizant	12,000
196	Jay Panara	160115734087	EEE	4th Year	Cognizant	12,000
197	Sai Teja Medepalli	160115734103	EEE	4th Year	Cognizant	12,000
198	Srinagh dhanunjai Chalasani	160115734112	EEE	4th Year	Cognizant	12,000
199	Anjani Durisety	160115737004	IT	4th Year	Cognizant	12,000
200	Bhavitha Maile	160115737008	IT	4th Year	Cognizant	12,000

201	Hari Priyanka SA	160115737012	IT	4th Year	Cognizant	12,000
202	pragna challa	160115737019	IT	4th Year	Cognizant	12,000
203	Dheeraj Reddy Jambula	160115737039	IT	4th Year	Cognizant	12,000
204	Pravin Kishore Koyalkar	160115737048	IT	4th Year	Cognizant	12,000
205	Vasudeva Gudimalla	160115737058	IT	4th Year	Cognizant	12,000
206	Vishal Anand Chenna	160115737059	IT	4th Year	Cognizant	12,000
207	Deepika Bomma	160115737064	IT	4th Year	Cognizant	12,000
208	Sai Rishitha Gorantla	160115737072	IT	4th Year	Cognizant	12,000
209	B. Shreeshma	160115737076	IT	4th Year	Cognizant	12,000
210	Hemanth Reddy Loka	160115737096	IT	4th Year	Cognizant	12,000
211	Sai kiran Chavan	160115737106	IT	4th Year	Cognizant	12,000
212	Sai Shashank Veesam	160115737108	IT	4th Year	Cognizant	12,000
213	Sanjeev Kumar DUMPALA	160115737111	IT	4th Year	Cognizant	12,000
214	Vivek Kumar Reddy H	160115737118	IT	4th Year	Cognizant	12,000
215	Yatish Chandra	160115737119	IT	4th Year	Cognizant	12,000
216	Kiran Kumar Chirra	160115737301	IT	4th Year	Cognizant	12,000
217	SONI MALKAPURAM	160115737317	IT	4th Year	Cognizant	12,000
218	Akhil Kandaloju	160115736016	Mech	4th Year	Cognizant	12,000
219	Rishi Teja Madduri	160115736034	Mech	4th Year	Cognizant	12,000
220	Vimmigari Sanjay kumar	160115736040	Mech	4th Year	Cognizant	12,000
221	Yashwanth Reddy Addula	160115736060	Mech	4th Year	Cognizant	12,000
222	Sathola Anand	160115736077	Mech	4th Year	Cognizant	12,000
223	HARSHITH BH	160115736086	Mech	4th Year	Cognizant	12,000
224	Tejasai Naredla	160115736113	Mech	4th Year	Cognizant	12,000
225	ALLU VENKATA SAI KUMAR	160115736303	Mech	4th Year	Cognizant	12,000
226	Srujan Alladurgam	160115738052	Prod	4th Year	Cognizant	12,000
227	Merugu nikhil Goud	160115735151	ECE	4th Year	CoreCompete	Performance based
228	Imran Mohammed	160115734092	EEE	4th Year	CoreCompete	Performance based
229	Mohammad SameeR	160115736029	Mechanical	4th Year	CoreCompete	Performance based
230	Nyalam Mahesh	160115736091	Mechanical	4th Year	CoreCompete	Performance based
231	Tadi Pavan Kumar	160115735048	ECE	4th Year	Corporatz	Performance based
232	Ravali.D	160115737068	IT	4th Year	Corporatz	Performance based
233	Ashwini	160115737319	IT	4th Year	Corporatz	Performance based
234	Veerabathini Anirudh Priyatham	160115737092	IT	4th Year	Corporatz	Performance based
235	Roshini P	160115737070	IT	4th Year	Corporatz	Performance based
236	Ujwal Dasari	160115737056	IT	4th Year	Corporatz	Performance based
237	Vinona	160115737083	IT	4th Year	Corporatz	Performance based
238	Ananya Veer	160115737089	IT	4th Year	Corporatz	Performance based
239	Adhokshaj Vemavarapu	160115737088	IT	4th Year	Corporatz	Performance based
240	Chikula Saikumar	160115733107	CSE2	4th Year	CtrlS Datacenters	10,000
241	Sonu Badugu	160115733055	CSE	4th Year	DarwinBox	15,000

242	Nisha Reddy	160115735069	ECE	4th Year	DarwinBox	15,000
243	Naga Rama Bhadra Kumar Malladi	160115733036	CSE	4th Year	Delhivery	25,000
244	Pavan Sai Ganji	160115733040	CSE	4th Year	Delhivery	25,000
245	Manoj kumar Badalgama	160115733093	CSE	4th Year	Delhivery	25,000
246	Chandrahas Reddy Mandapati	160115737037	IT	4th Year	Delhivery	25,000
247	Venkatesh Elaboina	160115733118	CSE	4th Year	EZE Software	20,000
248	Sree Hari Priya Bellam	160115733147	CSE	4th Year	GE Appliances	20,000
249	Monica K	160115733006	CSE	4th Year	GE Appliances	20,000
250	Jagannath Saragadam	160115737050	IT	4th Year	GE Appliances	20,000
251	Veeramreddy Sai Tejaswi	160115737024	IT	4th Year	GE Appliances	20,000
252	N.Rahul Chandra	160115733043	CSE	4th Year	Gemini Consulting	10,000
253	Samhita Alla	160115733013	CSE	4th Year	Gradvine	10,000
254	Sai Revannth Vedala	160115733050	CSE	4th Year	IBM	30,000
255	Apoorva ventrapragada	160115737006	IT	4th Year	IBM	30,000
256	Ram Ananya Tenneti	160115735104	ECE2	4th Year	IIIT Hyderabad	Yet to be decided
257	M/s P Hema Latha (Tech Apprentice)	160115735315	ECE2	4th Year	Indian Oil Corpn	17,000
258	Sravya Chowderpally	160115733146	CSE	4th Year	JPMC	27,500
259	Kanaparthi Vineeth Rao	160115733119	CSE	4th Year	JPMC	27,500
260	Anjani Vaddepally	160115733064	CSE	4th Year	JPMC	27,500
261	M.Ashvik	160115733086	CSE	4th Year	JPMC	27,500
262	Krishna Sri Somepalli	160115733128	CSE	4th Year	JPMC	27,500
263	Jella Nikhil Babu	160115733160	CSE	4th Year	JPMC	27,500
264	B Rohith reddy	160115733103	CSE	4th Year	JPMC	27,500
265	Kunda Rama Krishna	160115733162	CSE	4th Year	JPMC	27,500
266	R.Sahithi	160115733123	CSE	4th Year	JPMC	27,500
267	Harsh Rathi	160115733030	CSE	4th Year	JPMC	27,500
268	Richa Kulkarni	160115733137	CSE	4th Year	JPMC	27,500
269	Siddharth panday	160115737053	CSE	4th Year	JPMC	27,500
270	Shaik Roshna	160115735075	ECE	4th Year	JPMC	27,500
271	Vishnu Rohith Karanam	160115737060	IT	4th Year	JPMC	27,500
272	Sneha Reddy	160115737079	IT	4th Year	JPMC	27,500
273	V.Nikita	160115737018	IT	4th Year	JPMC	27,500
274	Ch. Sai Spandana	160115737023	IT	4th Year	JPMC	27,500
275	Shravya Sheela	160115737027	IT	4th Year	JPMC	27,500
276	Suraj	160115737115	IT	4th Year	JPMC	27,500
277	Pranavi Reddy	160115732010	Civil	4th Year	Karvy	10,000
278	Naveen Kumar Kandraju	160115733329	CSE	4th Year	Karvy	10,000
279	B.Mounika	160115733181	CSE	4th Year	Karvy	10,000
280	bhongiri tejaswi	160115733312	CSE	4th Year	Karvy	10,000
281	D.Devendranath	160115733028	CSE	4th Year	Karvy	10,000
282	Pranuthi kota	160115735312	ECE	4th Year	Karvy	10,000

283	Soumith Peketi	160115737054	IT	4th Year	Karvy	10,000
284	Nitya Ingale	160115737312	IT	4th Year	Karvy	10,000
285	Annam Chakravarthy	160115737036	IT	4th Year	Karvy	10,000
286	K VENKATADASU	160115737302	IT	4th Year	Karvy	10,000
287	Pavansai cherukuri	160115737047	IT	4th Year	Karvy	10,000
288	M Abhishek	160115737032	IT	4th Year	Karvy	10,000
289	Manish Kumar sadhu	160115733092	CSE	4th Year	Merilytics	20,000
290	Shreya Therupally	160115733016	CSE	4th Year	Merilytics	20,000
291	Butharaju Sravya	160115733076	CSE	4th Year	Merilytics	20,000
292	Madhurima Yella	160115733131	CSE	4th Year	Merilytics	20,000
293	Faraaz Ahmed	160115733155	CSE	4th Year	Merilytics	20,000
294	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	Merilytics	20,000
295	Rashmi Kapoor	160115734071	EEE	4th Year	Merilytics	20,000
296	Srikesh Pulluri	160115734111	EEE	4th Year	Merilytics	20,000
297	Bhavitha Maile	160115737008	IT	4th Year	Merilytics	20,000
298	N VENKATA SAI DHEERAJ	160115733117	CSE	4th Year	NCR	Yet to be decided
299	Abdul Wahed	160115733079	CSE	4th Year	NCR	Yet to be decided
300	Nikitha Krishna.V	160115733073	CSE	4th Year	NCR	Yet to be decided
301	D. Avanthika Shree	160115733065	CSE	4th Year	NCR	Yet to be decided
302	Ravi Chandran Reddy Kallem	160115733102	CSE	4th Year	NCR	Yet to be decided
303	S Harsha Vardhan Rao	160115733326	CSE	4th Year	NCR	Yet to be decided
304	Sahithi Reddy	160115733138	CSE	4th Year	NCR	Yet to be decided
305	Vangari Pallavi	160115733133	CSE	4th Year	NCR	Yet to be decided
306	Padala soumya	160115733145	CSE	4th Year	NCR	Yet to be decided
307	Shravanthi Mv	160115735084	ECE	4th Year	NCR	Yet to be decided
308	MEGHNA RAMAN	160115735127	ECE	4th Year	NCR	Yet to be decided
309	A. Ravi Teja	160115735107	ECE	4th Year	NCR	Yet to be decided
310	Sharanya Gandla	160115735020	ECE	4th Year	NCR	Yet to be decided
311	Soumya Sajja	160115735024	ECE	4th Year	NCR	Yet to be decided
312	Tanishka Vegunta	160115737080	IT	4th Year	NCR	Yet to be decided
313	pratik saxena	160115737102	IT	4th Year	NCR	Yet to be decided
314	Aditya Kuppa	160115733116	CSE	4th Year	Oracle	35,000
315	Thummala Anish Reddy	160115733085	CSE	4th Year	Oracle	35,000
316	Sagi Sai Nithish Varma	160115733167	CSE	4th Year	Oracle	35,000
317	Mothe Ajay	160115737315	IT	4th Year	PH Technolgies	8,000
318	Koushik Gadpale	160115737042	IT	4th Year	PH Technolgies	8,000
319	Anusha Gajja	160115737063	IT	4th Year	PH Technolgies	8,000
320	Sri Keerthi Reddy	160114732010	CIVIL	4th Year	Premier Developers	10,000
321	Usama bin Faheem	160115732058	CIVIL	4th Year	Premier Developers	10,000
322	Pranavi Reddy	160115732010	CIVIL	4th Year	Premier Developers	10,000
323	Altamash Siddiqui	160115732035	CIVIL	4th Year	Premier Developers	10,000

324	S. Spandana	160115732309	CIVIL	4th Year	Premier Developers	10,000
325	Akshay Kumar	160115736017	Mechanical	4th Year	Premier Developers	10,000
326	Lunavath Divya	160115736322	Mechanical	4th Year	Premier Developers	10,000
327	Praveen Gitta	160115736317	Mechanical	4th Year	Premier Developers	10,000
328	Shreshta Mahankali	160115736072	Mechanical	4th Year	Premier Developers	10,000
329	G Manasa	160115736066	Mechanical	4th Year	Premier Developers	10,000
330	Supriya Ponna	160115738010	Production	4th Year	Premier Developers	10,000
331	V Sai Teja	160115738048	Production	4th Year	Premier Developers	10,000
332	Y V Sai Bhavana	160115738006	Production	4th Year	Premier Developers	10,000
333	Mitesh Loya	160115738025	Production	4th Year	Premier Developers	10,000
334	Zeeshan	160115738027	Production	4th Year	Premier Developers	10,000
335	Sunayana	160115738008	Production	4th Year	Premier Developers	10,000
336	prapul reddy	160115738036	Production	4th Year	Premier Developers	10,000
337	mallikarjun Reddy	160115738024	Production	4th Year	Premier Developers	10,000
338	K Aneesha	160115738002	Production	4th Year	Premier Developers	10,000
339	Neha Fahreen	160116000000	CSE	4th Year	qualcomm	30,000
340	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	qualcomm	30,000
341	Adithi Reddy	160115735121	ECE	4th Year	qualcomm	30,000
342	Krishna Sri Somepalli	160115733128	CSE	4th Year	Samsung R&D	35,000
343	Bala Lakshmi Sai Sweta Sahithi Ramaraju	160115733123	CSE	4th Year	Samsung R&D	35,000
344	Anjani Vadepally	160115733064	CSE	4th Year	Samsung R&D	35,000
345	Sree Hari Priya Bellam	160115733147	CSE	4th Year	Samsung R&D	35,000
346	Susmitha Dhadige	160115733149	CSE	4th Year	Samsung R&D	35,000
347	D. Avanthika Shree	160115733065	CSE	4th Year	Samsung R&D	35,000
348	Samhita Alla	160115733013	CSE	4th Year	Samsung R&D	35,000
349	Asra Naseem	160115733002	CSE	4th Year	Samsung R&D	35,000
350	Bijja Ramya	160115733136	CSE	4th Year	Samsung R&D	35,000
351	Shreya Therupally	160115733016	CSE	4th Year	Samsung R&D	35,000
352	B. Pallavi	160115733008	CSE	4th Year	Samsung R&D	35,000
353	Koti Mahitha	160115733333	CSE	4th Year	Samsung R&D	35,000
354	Varalakshmi Vakkalagadda	160115737081	IT	4th Year	Samsung R&D	35,000
355	Nihitha Veeramachaneni	160115737067	IT	4th Year	Samsung R&D	35,000
356	Siddharth Gupta	160115733173	CSE	4th Year	ServiceNow	25,000
357	Apoorva Ventrapragada	160115737006	IT	4th Year	ServiceNow	25,000
358	Koyalkar Pravin Kishore	160115737048	IT	4th Year	TCS	15,000
359	Tayyala Sheshu	160115735113	ECE	4th Year	Veda IT	10,000
360	Nikhil Gattu	160115735101	ECE	4th Year	Veda IT	10,000
361	SAI NIRANJAN KARTHIK M	160115735165	ECE	4th Year	Veda IT	10,000
362	Jaya Maheedhar Manthripragada	160115735145	ECE	4th Year	Veda IT	10,000
363	Bachu Naveen Kumar	160115735100	ECE	4th Year	Veda IT	10,000
364	M.Nikhil	160115735152	ECE	4th Year	Veda IT	10,000
365	CS Priyanka	160115735074	ECE	4th Year	Veda IT	10,000
366	A SHIVA KRISHNA	160115735168	ECE	4th Year	Veda IT	10,000
367	Bindu Devalla	160115735065	ECE	4th Year	Veda IT	10,000

368	AKHIL SABBANI	160115735141	ECE	4th Year	Veda IT	10,000
369	Charita Dontireddy	160115733067	CSE	4th Year	Verisk Analytics	25,000
370	Neha Farheen	160115733132	CSE	4th Year	Verisk Analytics	25,000
371	Butharaju Sravya	160115733076	CSE	4th Year	Wells Fargo	25,000
372	ABRAR ATHAR HASHMI	160115733082	CSE	4th Year	Wells Fargo	25,000
373	Kannuri Ajay	160115733020	CSE	4th Year	Wells Fargo	25,000
374	Neha Komuravelly	160115733007	CSE	4th Year	Wells Fargo	25,000
375	Ramesh Rohith	160115735157	ECE	4th Year	Wells Fargo	25,000
376	Amit kumar	160115735142	ECE	4th Year	Wells Fargo	25,000
377	B .SAI CHARAN	160115735159	ECE	4th Year	Wells Fargo	25,000
378	Manasa vugge	160115734009	EEE	4th Year	Wells Fargo	25,000
379	Koyalkar Pravin Kishore	160115737048	IT	4th Year	Wells Fargo	25,000
380	Jyothsna	160115737014	IT	4th Year	Wells Fargo	25,000
381	Naga Akhil Belide	160115737100	IT	4th Year	Wells Fargo	25,000
382	Pragna challa	160115737019	IT	4th Year	Wells Fargo	25,000

Career Development Centre

Internship Offers Through Campus Recruiting Companies List 2018-19

Sl.No.	Name	Roll number	Branch	Year	Company	Stipend
1	Nagarjun Reddy Gurram	160115733037	CSE -1	4th Year	Accenture	15,000
2	GouthamiReddy Gidde	160115733305	CSE -1	4th Year	Accenture	15,000
3	Sai Lakshmi Keerthana Vogireddy	160115733011	CSE -1	4th Year	Accenture	15,000
4	Saivikhyath Chelamela	160115733052	CSE -1	4th Year	Accenture	15,000
5	Prasanna Danappagari	160115733308	CSE -1	4th Year	Accenture	15,000
6	Bhavya Guduru	160115733066	CSE -2	4th Year	Accenture	15,000
7	Rohith Reddy Singireddy	160115733104	CSE -2	4th Year	Accenture	15,000
8	Sushanth Samala	160115733115	CSE -2	4th Year	Accenture	15,000
9	Karthik Kedam	160115733089	CSE -2	4th Year	Accenture	15,000
10	Varun Kashyap	160115733090	CSE -2	4th Year	Accenture	15,000
11	Srikanth Karrre	160115733314	CSE -2	4th Year	Accenture	15,000
12	Kavyasree Karingla	160115733335	CSE -3	4th Year	Accenture	15,000
13	Gayatri Tawada	160115733124	CSE -3	4th Year	Accenture	15,000
14	Madhurima Yella	160115733131	CSE -3	4th Year	Accenture	15,000
15	Lakshman Amireddy	160115733158	CSE -3	4th Year	Accenture	15,000
16	Himanshu Ketan Kapashi	160115733157	CSE -3	4th Year	Accenture	15,000
17	Mehraj mohammed	160115733328	CSE -3	4th Year	Accenture	15,000
18	Katamoni Sreerupa	160115733310	CSE-1	4th Year	Accenture	15,000
19	MD Asif Ali	160115733094	CSE-2	4th Year	Accenture	15,000
20	Pranay Gaini	160115733161	CSE-3	4th Year	Accenture	15,000
21	KamalVamsi Mesa	160115735042	ECE-1	4th Year	Accenture	15,000
22	Anirudh Kodavatiganti	160115735036	ECE-1	4th Year	Accenture	15,000
23	Usharani Pathlavath	160115735029	ECE-1	4th Year	Accenture	15,000
24	Madhuri Kandi	160115735013	ECE-1	4th Year	Accenture	15,000
25	Vivek Kodepaka	160115735060	ECE-1	4th Year	Accenture	15,000
26	Ranjith Boorugula	160114735045	ECE-1	4th Year	Accenture	15,000
27	Harini Kolloju	160115735009	ECE-1	4th Year	Accenture	15,000
28	Arun Kumar Allam	160115735037	ECE-1	4th Year	Accenture	15,000
29	Apeksha Khairtabad	160115735002	ECE-1	4th Year	Accenture	15,000
30	Pavan Kumar Boorla	160115735307	ECE-1	4th Year	Accenture	15,000
31	Bhanu prakash Renikuntla	160115735089	ECE-2	4th Year	Accenture	15,000
32	Rajashekar Reddy Minipuri	160115735314	ECE-2	4th Year	Accenture	15,000
33	Bindu Devalla	160115735065	ECE-2	4th Year	Accenture	15,000
34	Saikumar Gajji	160115735110	ECE-2	4th Year	Accenture	15,000
35	Monika Satla	160115735068	ECE-2	4th Year	Accenture	15,000
36	Srikanth Naradasu	160115735105	ECE-2	4th Year	Accenture	15,000

37	Rahul Devunuri	160115735103	ECE-2	4th Year	Accenture	15,000
38	Ruchitha Ambothu	160115735073	ECE-2	4th Year	Accenture	15,000
39	Roshini Bijjala	160115735072	ECE-2	4th Year	Accenture	15,000
40	Suresh Kumar Begari	160115735173	ECE-3	4th Year	Accenture	15,000
41	Bhanu Challa	160115735143	ECE-3	4th Year	Accenture	15,000
42	Kasarla Sai Pratheek Reddy	160115735167	ECE-3	4th Year	Accenture	15,000
43	Mounika Amgoth	160115735128	ECE-3	4th Year	Accenture	15,000
44	Karthik reddy Gaddam	160115735146	ECE-3	4th Year	Accenture	15,000
45	Sujan Kumar Vasimalla	160115735171	ECE-3	4th Year	Accenture	15,000
46	Sabavath Janardhan	160115735335	ECE-3	4th Year	Accenture	15,000
47	Shiva shanth reddy Gurrala	160115735169	ECE-3	4th Year	Accenture	15,000
48	Arvind Keesara	160115735330	ECE-3	4th Year	Accenture	15,000
49	Varshitha Indukuri	160115735139	ECE-3	4th Year	Accenture	15,000
50	ADITYA Navuduri	160115734025	EEE-1	4th Year	Accenture	15,000
51	NITHYA REDDY Katepally	160115734010	EEE-1	4th Year	Accenture	15,000
52	TARUN SAI Potluri	160115734054	EEE-1	4th Year	Accenture	15,000
53	SHASHIDHAR MAMIDIPELLI	160115734051	EEE-1	4th Year	Accenture	15,000
54	SAI VAMSHI Akula	160114734046	EEE-1	4th Year	Accenture	15,000
55	Revanth Varma	160115734043	EEE-1	4th Year	Accenture	15,000
56	SAI CHARAN Pobbati	160115734045	EEE-1	4th Year	Accenture	15,000
57	VAISHNAVI Badhe	160115734023	EEE-1	4th Year	Accenture	15,000
58	SAI SURYA Indraganti	160114734045	EEE-1	4th Year	Accenture	15,000
59	Rahul Thandu	160115734041	EEE-1	4th Year	Accenture	15,000
60	PRITHVEESH Lingala	160115734039	EEE-1	4th Year	Accenture	15,000
61	SPOORTHY MUDDASANI	160115734016	EEE-1	4th Year	Accenture	15,000
62	Anukriti Singh	160115734001	EEE-1	4th Year	Accenture	15,000
63	KALPANA VALLAPUREDDY	160115734008	EEE-1	4th Year	Accenture	15,000
64	JULURI Ravikiran	160115734306	EEE-1	4th Year	Accenture	15,000
65	Jai Anusha Duggirala	160115734066	EEE-2	4th Year	Accenture	15,000
66	Sai vivek reddy Yedulla	160115734106	EEE-2	4th Year	Accenture	15,000
67	Sumegha Reddy Avula	160114734079	EEE-2	4th Year	Accenture	15,000
68	Sai Alekhya Datla	160115734072	EEE-2	4th Year	Accenture	15,000
69	Joel Vinod Singavarapu	160115734088	EEE-2	4th Year	Accenture	15,000
70	Divya Sai Nemmani	160115734064	EEE-2	4th Year	Accenture	15,000
71	Sirisha Kethavath	160115734078	EEE-2	4th Year	Accenture	15,000
72	Jahnavi Thotakura	160115734065	EEE-2	4th Year	Accenture	15,000
73	Premsagar Cheviti	160115734097	EEE-2	4th Year	Accenture	15,000
74	Amena Nousheen	160115734324	EEE-2	4th Year	Accenture	15,000
75	Javeed Meandad	160115734091	EEE-2	4th Year	Accenture	15,000
76	Supriya Chintala	160115734321	EEE-2	4th Year	Accenture	15,000
77	Soumya Dudka	160115734319	EEE-2	4th Year	Accenture	15,000

78	Shravani Bandikatla	160115734076	EEE-2	4th Year	Accenture	15,000
79	Swapna Gajjala	160114734082	EEE-2	4th Year	Accenture	15,000
80	Deepika Nadakuditi	160115734063	EEE-2	4th Year	Accenture	15,000
81	Geetha Julakanti	160115737011	IT -1	4th Year	Accenture	15,000
82	Ujwal Dasari	160115737056	IT -1	4th Year	Accenture	15,000
83	Srujan Tikayyolla	160115737055	IT -1	4th Year	Accenture	15,000
84	Madhuri Kurri	160115737016	IT -1	4th Year	Accenture	15,000
85	Satvika Yenigalla	160115737026	IT -1	4th Year	Accenture	15,000
86	Sonali Bandi	160115737029	IT -1	4th Year	Accenture	15,000
87	Aparna Reddy	160115737005	IT -1	4th Year	Accenture	15,000
88	Pavan Raj Gajarla	160115737046	IT -1	4th Year	Accenture	15,000
89	Jatin Lingala	160115737097	IT -2	4th Year	Accenture	15,000
90	Manish Enishetty	160115737099	IT -2	4th Year	Accenture	15,000
91	Krishna Teja Jamalapuram	160115737098	IT -2	4th Year	Accenture	15,000
92	Sai sandesh Goud Sunkishala	160115737110	IT -2	4th Year	Accenture	15,000
93	Abhinav Raju Nadimpally	160115737085	IT -2	4th Year	Accenture	15,000
94	Roshini Palle	160115737070	IT -2	4th Year	Accenture	15,000
95	Indrani Budigam	160115737065	IT -2	4th Year	Accenture	15,000
96	Rishi Chandana Chinthareddy	160115737069	IT -2	4th Year	Accenture	15,000
97	M SRINU NAIK	160115737114	IT-2	4th Year	Accenture	15,000
98	Sadeep Gurram	160115737314	IT-2	4th Year	Accenture	15,000
99	Harsha Vardhan Sankineni	160115733326	CSE	4th Year	Accolite	20,000
100	Madhukar Domakonda	160115733159	CSE	4th Year	Accolite	20,000
101	Matha Dileep	160115733153	CSE	4th Year	Accolite	20,000
102	Sai Deepa Bhavani Peri	160115737071	IT	4th Year	Accolite	20,000
103	Prathik Saxena	160115737102	IT	4th Year	Accolite	20,000
104	P Sai Kranti	160115737106	IT	4th Year	Accolite	20,000
105	M.Sri Manika	160115735079	ECE	4th Year	Alog Tech	8,000
106	Bhavesh Raja	160115805041	Bio-Tech	4th Year	Byju's	25,000
107	Aditya Kante	160115737033	IT	4th Year	Byju's	25,000
108	Bezawada Chiranjeevi	160115736081	Mech-2	4th Year	Byju's	25,000
109	Pavan Tarun	160115738034	Prod	4th Year	Byju's	25,000
110	M KRISHNAKANTH VASISTA	160115805053	Bio-Tech	4th Year	Capgemini	Yet to be decided
111	Kurapati Manideepika	160115802007	Chemical	4th Year	Capgemini	Yet to be decided
112	Dinesh Chowdary G	160115733154	CSE	4th Year	Capgemini	Yet to be decided
113	Rachana Kavukuntla	160115733134	CSE	4th Year	Capgemini	Yet to be decided
114	Samrat Bingi	160115733168	CSE	4th Year	Capgemini	Yet to be decided
115	Madhuri Vennu	160115733130	CSE	4th Year	Capgemini	Yet to be decided
116	Divya K	160115733069	CSE	4th Year	Capgemini	Yet to be decided
117	Meghana	160115733327	CSE	4th Year	Capgemini	Yet to be decided
118	KOPPULA GANESH	160115735332	ECE	4th Year	Capgemini	Yet to be decided

119	Mohammad Mansoor	160115735098	ECE	4th Year	Capgemini	Yet to be decided
120	Koppaka Sai Sri Chandana	160115735133	ECE	4th Year	Capgemini	Yet to be decided
121	Harshitha Ambilpur	160115735010	ECE	4th Year	Capgemini	Yet to be decided
122	T KAUSHAL	160115735043	ECE	4th Year	Capgemini	Yet to be decided
123	Tadi Pavan Kumar	160115735048	ECE	4th Year	Capgemini	Yet to be decided
124	Morampudi Uday	160115735059	ECE	4th Year	Capgemini	Yet to be decided
125	E.Radhika	160115735313	ECE	4th Year	Capgemini	Yet to be decided
126	MOHAMMAD NOMAN JUNAID	160115735148	ECE	4th Year	Capgemini	Yet to be decided
127	T. Lakshmi Deepika	160115735125	ECE	4th Year	Capgemini	Yet to be decided
128	Vishnu Pasula	160115734060	EEE	4th Year	Capgemini	Yet to be decided
129	Hari Charan Reddy V	160115734030	EEE	4th Year	Capgemini	Yet to be decided
130	M VAMSHI KRISHNA REDDY	160115734057	EEE	4th Year	Capgemini	Yet to be decided
131	Pranathi Reddy Mula	160115734011	EEE	4th Year	Capgemini	Yet to be decided
132	Kadevari Rohith	160115737049	IT	4th Year	Capgemini	Yet to be decided
133	Ashritha Polneni	160115737007	IT	4th Year	Capgemini	Yet to be decided
134	BhargavReddy Muthukuru	160115737094	IT	4th Year	Capgemini	Yet to be decided
135	Aditya Kante	160115737033	IT	4th Year	Capgemini	Yet to be decided
136	Sai Vivek Yeggadi	160115737109	IT	4th Year	Capgemini	Yet to be decided
137	Navya Gunti	160115736006	Mechanical	4th Year	Capgemini	Yet to be decided
138	Krishna sai vadapally	160115736089	Mechanical	4th Year	Capgemini	Yet to be decided
139	K Vihar	160115733178	CSE	4th Year	Caravel. AI	25,000
140	Rishi Vishwanadhan	160115805050	Bio-Tech	4th Year	CCMB	30,000
141	Mani Deepika Mallavarapu	160115805010	Bio-Tech	4th Year	CCMB	25,000
142	Himanshu Ketan Kapashi	160115733157	CSE -3	4th Year	Code Mani Green Tech Solutions	16.500
143	Rizwana Shaik	160115805030	BIO-Tech	4th Year	Cognizant	12,000
144	Tirumalasetty Vijay	160115802050	Chemical	4th Year	Cognizant	12,000
145	Akhil Konegari	160115732084	Civil	4th Year	Cognizant	12,000
146	Kolishetty Mahesh	160115732095	Civil	4th Year	Cognizant	12,000
147	Pallavi Byagari	160115733008	CSE	4th Year	Cognizant	12,000
148	Akhila Sirikonda	160115733001	CSE	4th Year	Cognizant	12,000
149	Keerthi Sanke	160115733004	CSE	4th Year	Cognizant	12,000
150	Monica K.	160115733006	CSE	4th Year	Cognizant	12,000
151	Shambhavi M	160115733014	CSE	4th Year	Cognizant	12,000
152	Shreya Therupally	160115733016	CSE	4th Year	Cognizant	12,000
153	Aravind Babu Somarapu	160115733023	CSE	4th Year	Cognizant	12,000
154	Hari Challa	160115733029	CSE	4th Year	Cognizant	12,000
155	Hemanth Reddy	160115733031	CSE	4th Year	Cognizant	12,000
156	Ithesh Muppaneni	160115733032	CSE	4th Year	Cognizant	12,000
157	Sai Allala	160115733049	CSE	4th Year	Cognizant	12,000
158	SRINATH TANGALLAPALLY	160115733056	CSE	4th Year	Cognizant	12,000
159	SRUJANVESH GOUD KOTHA	160115733057	CSE	4th Year	Cognizant	12,000

160	Aakanksha Vinnakoti	160115733061	CSE	4th Year	Cognizant	12,000
161	Thota Jyothi	160115733070	CSE	4th Year	Cognizant	12,000
162	shefali shireen	160115733075	CSE	4th Year	Cognizant	12,000
163	ABRAR ATHAR HASHMI	160115733082	CSE	4th Year	Cognizant	12,000
164	Harish Kumar Kathi	160115733087	CSE	4th Year	Cognizant	12,000
165	Praneeth Kumar Sajulu	160115733099	CSE	4th Year	Cognizant	12,000
166	Alekya Gujjala	160115733121	CSE	4th Year	Cognizant	12,000
167	Komal Puranik	160115733127	CSE	4th Year	Cognizant	12,000
168	Rachana Kavukuntla	160115733134	CSE	4th Year	Cognizant	12,000
169	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	Cognizant	12,000
170	Dileep Matha	160115733153	CSE	4th Year	Cognizant	12,000
171	Madhukar Domakonda	160115733159	CSE	4th Year	Cognizant	12,000
172	Uma Maheshwara Swamy D	160115733177	CSE	4th Year	Cognizant	12,000
173	Sharon Keerthana Chiluvuri	160115735021	ECE	4th Year	Cognizant	12,000
174	Suchithra Reddy Yellolu	160115735026	ECE	4th Year	Cognizant	12,000
175	Supraja Paloju	160115735027	ECE	4th Year	Cognizant	12,000
176	Abhilash Reddy Devarinti	160115735033	ECE	4th Year	Cognizant	12,000
177	Anil kumar	160115735035	ECE	4th Year	Cognizant	12,000
178	Raghuram Chepuri	160115735049	ECE	4th Year	Cognizant	12,000
179	Sarparapu Divya Sri	160115735066	ECE	4th Year	Cognizant	12,000
180	Goutham Sadubathula	160115735092	ECE	4th Year	Cognizant	12,000
181	Methuku Mohan Kumar	160115735099	ECE	4th Year	Cognizant	12,000
182	Liji p Jose	160115735126	ECE	4th Year	Cognizant	12,000
183	Poojitha Borra	160115735129	ECE	4th Year	Cognizant	12,000
184	baswa sairama amulya	160115735134	ECE	4th Year	Cognizant	12,000
185	K Sampangi Tejaswini	160115735135	ECE	4th Year	Cognizant	12,000
186	Ulligadda sreeja	160115735137	ECE	4th Year	Cognizant	12,000
187	Amit Anchaliya	160115735142	ECE	4th Year	Cognizant	12,000
188	Nikhil Madhunala	160115735152	ECE	4th Year	Cognizant	12,000
189	Latha Gunja	160115735322	ECE	4th Year	Cognizant	12,000
190	BHAGYA SRI G	160115734003	EEE	4th Year	Cognizant	12,000
191	HARITHA RACHURI	160115734005	EEE	4th Year	Cognizant	12,000
192	SHIVAPRIYA CHADA	160115734014	EEE	4th Year	Cognizant	12,000
193	SRINIJA REDDY KAMATHAM	160115734018	EEE	4th Year	Cognizant	12,000
194	VAISHNAVI AVADHANAM	160115734022	EEE	4th Year	Cognizant	12,000
195	AKASH GUNTI	160115734026	EEE	4th Year	Cognizant	12,000
196	Jay Panara	160115734087	EEE	4th Year	Cognizant	12,000
197	Sai Teja Medepalli	160115734103	EEE	4th Year	Cognizant	12,000
198	Srinagh dhanunjai Chalasani	160115734112	EEE	4th Year	Cognizant	12,000
199	Anjani Durisety	160115737004	IT	4th Year	Cognizant	12,000
200	Bhavitha Maile	160115737008	IT	4th Year	Cognizant	12,000

201	Hari Priyanka SA	160115737012	IT	4th Year	Cognizant	12,000
202	pragna challa	160115737019	IT	4th Year	Cognizant	12,000
203	Dheeraj Reddy Jambula	160115737039	IT	4th Year	Cognizant	12,000
204	Pravin Kishore Koyalkar	160115737048	IT	4th Year	Cognizant	12,000
205	Vasudeva Gudimalla	160115737058	IT	4th Year	Cognizant	12,000
206	Vishal Anand Chenna	160115737059	IT	4th Year	Cognizant	12,000
207	Deepika Bomma	160115737064	IT	4th Year	Cognizant	12,000
208	Sai Rishitha Gorantla	160115737072	IT	4th Year	Cognizant	12,000
209	B. Shreeshma	160115737076	IT	4th Year	Cognizant	12,000
210	Hemanth Reddy Loka	160115737096	IT	4th Year	Cognizant	12,000
211	Sai kiran Chavan	160115737106	IT	4th Year	Cognizant	12,000
212	Sai Shashank Veesam	160115737108	IT	4th Year	Cognizant	12,000
213	Sanjeev Kumar DUMPALA	160115737111	IT	4th Year	Cognizant	12,000
214	Vivek Kumar Reddy H	160115737118	IT	4th Year	Cognizant	12,000
215	Yatish Chandra	160115737119	IT	4th Year	Cognizant	12,000
216	Kiran Kumar Chirra	160115737301	IT	4th Year	Cognizant	12,000
217	SONI MALKAPURAM	160115737317	IT	4th Year	Cognizant	12,000
218	Akhil Kandaloju	160115736016	Mech	4th Year	Cognizant	12,000
219	Rishi Teja Madduri	160115736034	Mech	4th Year	Cognizant	12,000
220	Vimmigari Sanjay kumar	160115736040	Mech	4th Year	Cognizant	12,000
221	Yashwanth Reddy Addula	160115736060	Mech	4th Year	Cognizant	12,000
222	Sathola Anand	160115736077	Mech	4th Year	Cognizant	12,000
223	HARSHITH BH	160115736086	Mech	4th Year	Cognizant	12,000
224	Tejasai Naredla	160115736113	Mech	4th Year	Cognizant	12,000
225	ALLU VENKATA SAI KUMAR	160115736303	Mech	4th Year	Cognizant	12,000
226	Srujan Alladurgam	160115738052	Prod	4th Year	Cognizant	12,000
227	Merugu nikhil Goud	160115735151	ECE	4th Year	CoreCompete	Performance based
228	Imran Mohammed	160115734092	EEE	4th Year	CoreCompete	Performance based
229	Mohammad SameeR	160115736029	Mechanical	4th Year	CoreCompete	Performance based
230	Nyalam Mahesh	160115736091	Mechanical	4th Year	CoreCompete	Performance based
231	Tadi Pavan Kumar	160115735048	ECE	4th Year	Corporatz	Performance based
232	Ravali.D	160115737068	IT	4th Year	Corporatz	Performance based
233	Ashwini	160115737319	IT	4th Year	Corporatz	Performance based
234	Veerabathini Anirudh Priyatham	160115737092	IT	4th Year	Corporatz	Performance based
235	Roshini P	160115737070	IT	4th Year	Corporatz	Performance based
236	Ujwal Dasari	160115737056	IT	4th Year	Corporatz	Performance based
237	Vinona	160115737083	IT	4th Year	Corporatz	Performance based
238	Ananya Veer	160115737089	IT	4th Year	Corporatz	Performance based
239	Adhokshaj Vemavarapu	160115737088	IT	4th Year	Corporatz	Performance based
240	Chikula Saikumar	160115733107	CSE2	4th Year	CtrlS Datacenters	10,000
241	Sonu Badugu	160115733055	CSE	4th Year	DarwinBox	15,000

242	Nisha Reddy	160115735069	ECE	4th Year	DarwinBox	15,000
243	Naga Rama Bhadra Kumar Malladi	160115733036	CSE	4th Year	Delhivery	25,000
244	Pavan Sai Ganji	160115733040	CSE	4th Year	Delhivery	25,000
245	Manoj kumar Badalgama	160115733093	CSE	4th Year	Delhivery	25,000
246	Chandrahas Reddy Mandapati	160115737037	IT	4th Year	Delhivery	25,000
247	Venkatesh Elaboina	160115733118	CSE	4th Year	EZE Software	20,000
248	Sree Hari Priya Bellam	160115733147	CSE	4th Year	GE Appliances	20,000
249	Monica K	160115733006	CSE	4th Year	GE Appliances	20,000
250	Jagannath Saragadam	160115737050	IT	4th Year	GE Appliances	20,000
251	Veeramreddy Sai Tejaswi	160115737024	IT	4th Year	GE Appliances	20,000
252	N.Rahul Chandra	160115733043	CSE	4th Year	Gemini Consulting	10,000
253	Samhita Alla	160115733013	CSE	4th Year	Gradvine	10,000
254	Sai Revannth Vedala	160115733050	CSE	4th Year	IBM	30,000
255	Apoorva ventrapragada	160115737006	IT	4th Year	IBM	30,000
256	Ram Ananya Tenneti	160115735104	ECE2	4th Year	IIIT Hyderabad	Yet to be decided
257	M/s P Hema Latha (Tech Apprentice)	160115735315	ECE2	4th Year	Indian Oil Corpn	17,000
258	Sravya Chowderpally	160115733146	CSE	4th Year	JPMC	27,500
259	Kanaparthi Vineeth Rao	160115733119	CSE	4th Year	JPMC	27,500
260	Anjani Vaddepally	160115733064	CSE	4th Year	JPMC	27,500
261	M.Ashvik	160115733086	CSE	4th Year	JPMC	27,500
262	Krishna Sri Somepalli	160115733128	CSE	4th Year	JPMC	27,500
263	Jella Nikhil Babu	160115733160	CSE	4th Year	JPMC	27,500
264	B Rohith reddy	160115733103	CSE	4th Year	JPMC	27,500
265	Kunda Rama Krishna	160115733162	CSE	4th Year	JPMC	27,500
266	R.Sahithi	160115733123	CSE	4th Year	JPMC	27,500
267	Harsh Rathi	160115733030	CSE	4th Year	JPMC	27,500
268	Richa Kulkarni	160115733137	CSE	4th Year	JPMC	27,500
269	Siddharth panday	160115737053	CSE	4th Year	JPMC	27,500
270	Shaik Roshna	160115735075	ECE	4th Year	JPMC	27,500
271	Vishnu Rohith Karanam	160115737060	IT	4th Year	JPMC	27,500
272	Sneha Reddy	160115737079	IT	4th Year	JPMC	27,500
273	V.Nikita	160115737018	IT	4th Year	JPMC	27,500
274	Ch. Sai Spandana	160115737023	IT	4th Year	JPMC	27,500
275	Shravya Sheela	160115737027	IT	4th Year	JPMC	27,500
276	Suraj	160115737115	IT	4th Year	JPMC	27,500
277	Pranavi Reddy	160115732010	Civil	4th Year	Karvy	10,000
278	Naveen Kumar Kandraju	160115733329	CSE	4th Year	Karvy	10,000
279	B.Mounika	160115733181	CSE	4th Year	Karvy	10,000
280	bhongiri tejaswi	160115733312	CSE	4th Year	Karvy	10,000
281	D.Devendranath	160115733028	CSE	4th Year	Karvy	10,000
282	Pranuthi kota	160115735312	ECE	4th Year	Karvy	10,000

283	Soumith Peketi	160115737054	IT	4th Year	Karvy	10,000
284	Nitya Ingale	160115737312	IT	4th Year	Karvy	10,000
285	Annam Chakravarthy	160115737036	IT	4th Year	Karvy	10,000
286	K VENKATADASU	160115737302	IT	4th Year	Karvy	10,000
287	Pavansai cherukuri	160115737047	IT	4th Year	Karvy	10,000
288	M Abhishek	160115737032	IT	4th Year	Karvy	10,000
289	Manish Kumar sadhu	160115733092	CSE	4th Year	Merilytics	20,000
290	Shreya Therupally	160115733016	CSE	4th Year	Merilytics	20,000
291	Butharaju Sravya	160115733076	CSE	4th Year	Merilytics	20,000
292	Madhurima Yella	160115733131	CSE	4th Year	Merilytics	20,000
293	Faraaz Ahmed	160115733155	CSE	4th Year	Merilytics	20,000
294	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	Merilytics	20,000
295	Rashmi Kapoor	160115734071	EEE	4th Year	Merilytics	20,000
296	Srikesh Pulluri	160115734111	EEE	4th Year	Merilytics	20,000
297	Bhavitha Maile	160115737008	IT	4th Year	Merilytics	20,000
298	N VENKATA SAI DHEERAJ	160115733117	CSE	4th Year	NCR	Yet to be decided
299	Abdul Wahed	160115733079	CSE	4th Year	NCR	Yet to be decided
300	Nikitha Krishna.V	160115733073	CSE	4th Year	NCR	Yet to be decided
301	D. Avanthika Shree	160115733065	CSE	4th Year	NCR	Yet to be decided
302	Ravi Chandran Reddy Kallem	160115733102	CSE	4th Year	NCR	Yet to be decided
303	S Harsha Vardhan Rao	160115733326	CSE	4th Year	NCR	Yet to be decided
304	Sahithi Reddy	160115733138	CSE	4th Year	NCR	Yet to be decided
305	Vangari Pallavi	160115733133	CSE	4th Year	NCR	Yet to be decided
306	Padala soumya	160115733145	CSE	4th Year	NCR	Yet to be decided
307	Shravanthi Mv	160115735084	ECE	4th Year	NCR	Yet to be decided
308	MEGHNA RAMAN	160115735127	ECE	4th Year	NCR	Yet to be decided
309	A. Ravi Teja	160115735107	ECE	4th Year	NCR	Yet to be decided
310	Sharanya Gandla	160115735020	ECE	4th Year	NCR	Yet to be decided
311	Soumya Sajja	160115735024	ECE	4th Year	NCR	Yet to be decided
312	Tanishka Vegunta	160115737080	IT	4th Year	NCR	Yet to be decided
313	pratik saxena	160115737102	IT	4th Year	NCR	Yet to be decided
314	Aditya Kuppa	160115733116	CSE	4th Year	Oracle	35,000
315	Thummala Anish Reddy	160115733085	CSE	4th Year	Oracle	35,000
316	Sagi Sai Nithish Varma	160115733167	CSE	4th Year	Oracle	35,000
317	Mothe Ajay	160115737315	IT	4th Year	PH Technolgies	8,000
318	Koushik Gadpale	160115737042	IT	4th Year	PH Technolgies	8,000
319	Anusha Gajja	160115737063	IT	4th Year	PH Technolgies	8,000
320	Sri Keerthi Reddy	160114732010	CIVIL	4th Year	Premier Developers	10,000
321	Usama bin Faheem	160115732058	CIVIL	4th Year	Premier Developers	10,000
322	Pranavi Reddy	160115732010	CIVIL	4th Year	Premier Developers	10,000
323	Altamash Siddiqui	160115732035	CIVIL	4th Year	Premier Developers	10,000

324	S. Spandana	160115732309	CIVIL	4th Year	Premier Developers	10,000
325	Akshay Kumar	160115736017	Mechanical	4th Year	Premier Developers	10,000
326	Lunavath Divya	160115736322	Mechanical	4th Year	Premier Developers	10,000
327	Praveen Gitta	160115736317	Mechanical	4th Year	Premier Developers	10,000
328	Shreshta Mahankali	160115736072	Mechanical	4th Year	Premier Developers	10,000
329	G Manasa	160115736066	Mechanical	4th Year	Premier Developers	10,000
330	Supriya Ponna	160115738010	Production	4th Year	Premier Developers	10,000
331	V Sai Teja	160115738048	Production	4th Year	Premier Developers	10,000
332	Y V Sai Bhavana	160115738006	Production	4th Year	Premier Developers	10,000
333	Mitesh Loya	160115738025	Production	4th Year	Premier Developers	10,000
334	Zeeshan	160115738027	Production	4th Year	Premier Developers	10,000
335	Sunayana	160115738008	Production	4th Year	Premier Developers	10,000
336	prapul reddy	160115738036	Production	4th Year	Premier Developers	10,000
337	mallikarjun Reddy	160115738024	Production	4th Year	Premier Developers	10,000
338	K Aneesha	160115738002	Production	4th Year	Premier Developers	10,000
339	Neha Fahreen	160116000000	CSE	4th Year	qualcomm	30,000
340	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	qualcomm	30,000
341	Adithi Reddy	160115735121	ECE	4th Year	qualcomm	30,000
342	Krishna Sri Somepalli	160115733128	CSE	4th Year	Samsung R&D	35,000
343	Bala Lakshmi Sai Sweta Sahithi Ramaraju	160115733123	CSE	4th Year	Samsung R&D	35,000
344	Anjani Vadepally	160115733064	CSE	4th Year	Samsung R&D	35,000
345	Sree Hari Priya Bellam	160115733147	CSE	4th Year	Samsung R&D	35,000
346	Susmitha Dhadige	160115733149	CSE	4th Year	Samsung R&D	35,000
347	D. Avanthika Shree	160115733065	CSE	4th Year	Samsung R&D	35,000
348	Samhita Alla	160115733013	CSE	4th Year	Samsung R&D	35,000
349	Asra Naseem	160115733002	CSE	4th Year	Samsung R&D	35,000
350	Bijja Ramya	160115733136	CSE	4th Year	Samsung R&D	35,000
351	Shreya Therupally	160115733016	CSE	4th Year	Samsung R&D	35,000
352	B. Pallavi	160115733008	CSE	4th Year	Samsung R&D	35,000
353	Koti Mahitha	160115733333	CSE	4th Year	Samsung R&D	35,000
354	Varalakshmi Vakkalagadda	160115737081	IT	4th Year	Samsung R&D	35,000
355	Nihitha Veeramachaneni	160115737067	IT	4th Year	Samsung R&D	35,000
356	Siddharth Gupta	160115733173	CSE	4th Year	ServiceNow	25,000
357	Apoorva Ventrapragada	160115737006	IT	4th Year	ServiceNow	25,000
358	Koyalkar Pravin Kishore	160115737048	IT	4th Year	TCS	15,000
359	Tayyala Sheshu	160115735113	ECE	4th Year	Veda IT	10,000
360	Nikhil Gattu	160115735101	ECE	4th Year	Veda IT	10,000
361	SAI NIRANJAN KARTHIK M	160115735165	ECE	4th Year	Veda IT	10,000
362	Jaya Maheedhar Manthripragada	160115735145	ECE	4th Year	Veda IT	10,000
363	Bachu Naveen Kumar	160115735100	ECE	4th Year	Veda IT	10,000
364	M.Nikhil	160115735152	ECE	4th Year	Veda IT	10,000
365	CS Priyanka	160115735074	ECE	4th Year	Veda IT	10,000
366	A SHIVA KRISHNA	160115735168	ECE	4th Year	Veda IT	10,000
367	Bindu Devalla	160115735065	ECE	4th Year	Veda IT	10,000

368	AKHIL SABBANI	160115735141	ECE	4th Year	Veda IT	10,000
369	Charita Dontireddy	160115733067	CSE	4th Year	Verisk Analytics	25,000
370	Neha Farheen	160115733132	CSE	4th Year	Verisk Analytics	25,000
371	Butharaju Sravya	160115733076	CSE	4th Year	Wells Fargo	25,000
372	ABRAR ATHAR HASHMI	160115733082	CSE	4th Year	Wells Fargo	25,000
373	Kannuri Ajay	160115733020	CSE	4th Year	Wells Fargo	25,000
374	Neha Komuravelly	160115733007	CSE	4th Year	Wells Fargo	25,000
375	Ramesh Rohith	160115735157	ECE	4th Year	Wells Fargo	25,000
376	Amit kumar	160115735142	ECE	4th Year	Wells Fargo	25,000
377	B .SAI CHARAN	160115735159	ECE	4th Year	Wells Fargo	25,000
378	Manasa vugge	160115734009	EEE	4th Year	Wells Fargo	25,000
379	Koyalkar Pravin Kishore	160115737048	IT	4th Year	Wells Fargo	25,000
380	Jyothsna	160115737014	IT	4th Year	Wells Fargo	25,000
381	Naga Akhil Belide	160115737100	IT	4th Year	Wells Fargo	25,000
382	Pragna challa	160115737019	IT	4th Year	Wells Fargo	25,000

Career Development Centre

Internship Offers Through Campus Recruiting Companies List 2018-19

Sl.No.	Name	Roll number	Branch	Year	Company	Stipend
1	Nagarjun Reddy Gurram	160115733037	CSE -1	4th Year	Accenture	15,000
2	GouthamiReddy Gidde	160115733305	CSE -1	4th Year	Accenture	15,000
3	Sai Lakshmi Keerthana Vogireddy	160115733011	CSE -1	4th Year	Accenture	15,000
4	Saivikhyath Chelamela	160115733052	CSE -1	4th Year	Accenture	15,000
5	Prasanna Danappagari	160115733308	CSE -1	4th Year	Accenture	15,000
6	Bhavya Guduru	160115733066	CSE -2	4th Year	Accenture	15,000
7	Rohith Reddy Singireddy	160115733104	CSE -2	4th Year	Accenture	15,000
8	Sushanth Samala	160115733115	CSE -2	4th Year	Accenture	15,000
9	Karthik Kedam	160115733089	CSE -2	4th Year	Accenture	15,000
10	Varun Kashyap	160115733090	CSE -2	4th Year	Accenture	15,000
11	Srikanth Karrre	160115733314	CSE -2	4th Year	Accenture	15,000
12	Kavyasree Karingla	160115733335	CSE -3	4th Year	Accenture	15,000
13	Gayatri Tawada	160115733124	CSE -3	4th Year	Accenture	15,000
14	Madhurima Yella	160115733131	CSE -3	4th Year	Accenture	15,000
15	Lakshman Amireddy	160115733158	CSE -3	4th Year	Accenture	15,000
16	Himanshu Ketan Kapashi	160115733157	CSE -3	4th Year	Accenture	15,000
17	Mehraj mohammed	160115733328	CSE -3	4th Year	Accenture	15,000
18	Katamoni Sreerupa	160115733310	CSE-1	4th Year	Accenture	15,000
19	MD Asif Ali	160115733094	CSE-2	4th Year	Accenture	15,000
20	Pranay Gaini	160115733161	CSE-3	4th Year	Accenture	15,000
21	KamalVamsi Mesa	160115735042	ECE-1	4th Year	Accenture	15,000
22	Anirudh Kodavatiganti	160115735036	ECE-1	4th Year	Accenture	15,000
23	Usharani Pathlavath	160115735029	ECE-1	4th Year	Accenture	15,000
24	Madhuri Kandi	160115735013	ECE-1	4th Year	Accenture	15,000
25	Vivek Kodepaka	160115735060	ECE-1	4th Year	Accenture	15,000
26	Ranjith Boorugula	160114735045	ECE-1	4th Year	Accenture	15,000
27	Harini Kolloju	160115735009	ECE-1	4th Year	Accenture	15,000
28	Arun Kumar Allam	160115735037	ECE-1	4th Year	Accenture	15,000
29	Apeksha Khairtabad	160115735002	ECE-1	4th Year	Accenture	15,000
30	Pavan Kumar Boorla	160115735307	ECE-1	4th Year	Accenture	15,000
31	Bhanu prakash Renikuntla	160115735089	ECE-2	4th Year	Accenture	15,000
32	Rajashekar Reddy Minipuri	160115735314	ECE-2	4th Year	Accenture	15,000
33	Bindu Devalla	160115735065	ECE-2	4th Year	Accenture	15,000
34	Saikumar Gajji	160115735110	ECE-2	4th Year	Accenture	15,000

35	Monika Satla	160115735068	ECE-2	4th Year	Accenture	15,000
36	Srikanth Naradasu	160115735105	ECE-2	4th Year	Accenture	15,000
37	Rahul Devunuri	160115735103	ECE-2	4th Year	Accenture	15,000
38	Ruchitha Ambothu	160115735073	ECE-2	4th Year	Accenture	15,000
39	Roshini Bijjala	160115735072	ECE-2	4th Year	Accenture	15,000
40	Suresh Kumar Begari	160115735173	ECE-3	4th Year	Accenture	15,000
41	Bhanu Challa	160115735143	ECE-3	4th Year	Accenture	15,000
42	Kasarla Sai Pratheek Reddy	160115735167	ECE-3	4th Year	Accenture	15,000
43	Mounika Amgoth	160115735128	ECE-3	4th Year	Accenture	15,000
44	Karthik reddy Gaddam	160115735146	ECE-3	4th Year	Accenture	15,000
45	Sujan Kumar Vasimalla	160115735171	ECE-3	4th Year	Accenture	15,000
46	Sabavath Janardhan	160115735335	ECE-3	4th Year	Accenture	15,000
47	Shiva shanth reddy Gurrala	160115735169	ECE-3	4th Year	Accenture	15,000
48	Arvind Keesara	160115735330	ECE-3	4th Year	Accenture	15,000
49	Varshitha Indukuri	160115735139	ECE-3	4th Year	Accenture	15,000
50	ADITYA Navuduri	160115734025	EEE-1	4th Year	Accenture	15,000
51	NITHYA REDDY Katepally	160115734010	EEE-1	4th Year	Accenture	15,000
52	TARUN SAI Potluri	160115734054	EEE-1	4th Year	Accenture	15,000
53	SHASHIDHAR MAMIDIPELLI	160115734051	EEE-1	4th Year	Accenture	15,000
54	SAI VAMSHI Akula	160114734046	EEE-1	4th Year	Accenture	15,000
55	Revanth Varma	160115734043	EEE-1	4th Year	Accenture	15,000
56	SAI CHARAN Pobbati	160115734045	EEE-1	4th Year	Accenture	15,000
57	VAISHNAVI Badhe	160115734023	EEE-1	4th Year	Accenture	15,000
58	SAI SURYA Indraganti	160114734045	EEE-1	4th Year	Accenture	15,000
59	Rahul Thandu	160115734041	EEE-1	4th Year	Accenture	15,000
60	PRITHVEESH Lingala	160115734039	EEE-1	4th Year	Accenture	15,000
61	SPOORTHY MUDDASANI	160115734016	EEE-1	4th Year	Accenture	15,000
62	Anukriti Singh	160115734001	EEE-1	4th Year	Accenture	15,000
63	KALPANA VALLAPUREDDY	160115734008	EEE-1	4th Year	Accenture	15,000
64	JULURI Ravikiran	160115734306	EEE-1	4th Year	Accenture	15,000
65	Jai Anusha Duggirala	160115734066	EEE-2	4th Year	Accenture	15,000
66	Sai vivek reddy Yedulla	160115734106	EEE-2	4th Year	Accenture	15,000
67	Sumegha Reddy Avula	160114734079	EEE-2	4th Year	Accenture	15,000
68	Sai Alekhya Datla	160115734072	EEE-2	4th Year	Accenture	15,000
69	Joel Vinod Singavarapu	160115734088	EEE-2	4th Year	Accenture	15,000
70	Divya Sai Nemmani	160115734064	EEE-2	4th Year	Accenture	15,000
71	Sirisha Kethavath	160115734078	EEE-2	4th Year	Accenture	15,000
72	Jahnavi Thotakura	160115734065	EEE-2	4th Year	Accenture	15,000
73	Premsagar Cheviti	160115734097	EEE-2	4th Year	Accenture	15,000

74	Amena Nousheen	160115734324	EEE-2	4th Year	Accenture	15,000
75	Javeed Meandad	160115734091	EEE-2	4th Year	Accenture	15,000
76	Supriya Chintala	160115734321	EEE-2	4th Year	Accenture	15,000
77	Soumya Dudka	160115734319	EEE-2	4th Year	Accenture	15,000
78	Shravani Bandikatla	160115734076	EEE-2	4th Year	Accenture	15,000
79	Swapna Gajjala	160114734082	EEE-2	4th Year	Accenture	15,000
80	Deepika Nadakuditi	160115734063	EEE-2	4th Year	Accenture	15,000
81	Geetha Julakanti	160115737011	IT -1	4th Year	Accenture	15,000
82	Ujwal Dasari	160115737056	IT -1	4th Year	Accenture	15,000
83	Srujan Tikayyolla	160115737055	IT -1	4th Year	Accenture	15,000
84	Madhuri Kurri	160115737016	IT -1	4th Year	Accenture	15,000
85	Satvika Yenigalla	160115737026	IT -1	4th Year	Accenture	15,000
86	Sonali Bandi	160115737029	IT -1	4th Year	Accenture	15,000
87	Aparna Reddy	160115737005	IT -1	4th Year	Accenture	15,000
88	Pavan Raj Gajarla	160115737046	IT -1	4th Year	Accenture	15,000
89	Jatin Lingala	160115737097	IT -2	4th Year	Accenture	15,000
90	Manish Enishetty	160115737099	IT -2	4th Year	Accenture	15,000
91	Krishna Teja Jamalapuram	160115737098	IT -2	4th Year	Accenture	15,000
92	Sai sandesh Goud Sunkishala	160115737110	IT -2	4th Year	Accenture	15,000
93	Abhinav Raju Nadimpally	160115737085	IT -2	4th Year	Accenture	15,000
94	Roshini Palle	160115737070	IT -2	4th Year	Accenture	15,000
95	Indrani Budigam	160115737065	IT -2	4th Year	Accenture	15,000
96	Rishi Chandana Chinthareddy	160115737069	IT -2	4th Year	Accenture	15,000
97	M SRINU NAIK	160115737114	IT-2	4th Year	Accenture	15,000
98	Sadeep Gurram	160115737314	IT-2	4th Year	Accenture	15,000
99	Harsha Vardhan Sankineni	160115733326	CSE	4th Year	Accolite	20,000
100	Madhukar Domakonda	160115733159	CSE	4th Year	Accolite	20,000
101	Matha Dileep	160115733153	CSE	4th Year	Accolite	20,000
102	Sai Deepa Bhavani Peri	160115737071	IT	4th Year	Accolite	20,000
103	Prathik Saxena	160115737102	IT	4th Year	Accolite	20,000
104	P Sai Kranti	160115737106	IT	4th Year	Accolite	20,000
105	M.Sri Manika	160115735079	ECE	4th Year	Alog Tech	8,000
106	Bhavesh Raja	160115805041	Bio-Tech	4th Year	Byju's	25,000
107	Aditya Kante	160115737033	IT	4th Year	Byju's	25,000
108	Bezawada Chiranjeevi	160115736081	Mech-2	4th Year	Byju's	25,000
109	Pavan Tarun	160115738034	Prod	4th Year	Byju's	25,000
110	M KRISHNAKANTH VASISTA	160115805053	Bio-Tech	4th Year	Capgemini	Yet to be decided
111	Kurapati Manideepika	160115802007	Chemical	4th Year	Capgemini	Yet to be decided
112	Dinesh Chowdary G	160115733154	CSE	4th Year	Capgemini	Yet to be decided

113	Rachana Kavukuntla	160115733134	CSE	4th Year	Capgemini	Yet to be decided
114	Samrat Bingi	160115733168	CSE	4th Year	Capgemini	Yet to be decided
115	Madhuri Vennu	160115733130	CSE	4th Year	Capgemini	Yet to be decided
116	Divya K	160115733069	CSE	4th Year	Capgemini	Yet to be decided
117	Meghana	160115733327	CSE	4th Year	Capgemini	Yet to be decided
118	KOPPULA GANESH	160115735332	ECE	4th Year	Capgemini	Yet to be decided
119	Mohammad Mansoor	160115735098	ECE	4th Year	Capgemini	Yet to be decided
120	Koppaka Sai Sri Chandana	160115735133	ECE	4th Year	Capgemini	Yet to be decided
121	Harshitha Ambilpur	160115735010	ECE	4th Year	Capgemini	Yet to be decided
122	T KAUSHAL	160115735043	ECE	4th Year	Capgemini	Yet to be decided
123	Tadi Pavan Kumar	160115735048	ECE	4th Year	Capgemini	Yet to be decided
124	Morampudi Uday	160115735059	ECE	4th Year	Capgemini	Yet to be decided
125	E.Radhika	160115735313	ECE	4th Year	Capgemini	Yet to be decided
126	MOHAMMAD NOMAN JUNAID	160115735148	ECE	4th Year	Capgemini	Yet to be decided
127	T. Lakshmi Deepika	160115735125	ECE	4th Year	Capgemini	Yet to be decided
128	Vishnu Pasula	160115734060	EEE	4th Year	Capgemini	Yet to be decided
129	Hari Charan Reddy V	160115734030	EEE	4th Year	Capgemini	Yet to be decided
130	M VAMSHI KRISHNA REDDY	160115734057	EEE	4th Year	Capgemini	Yet to be decided
131	Pranathi Reddy Mula	160115734011	EEE	4th Year	Capgemini	Yet to be decided
132	Kadevari Rohith	160115737049	IT	4th Year	Capgemini	Yet to be decided
133	Ashritha Polneni	160115737007	IT	4th Year	Capgemini	Yet to be decided
134	BhargavReddy Muthukuru	160115737094	IT	4th Year	Capgemini	Yet to be decided
135	Aditya Kante	160115737033	IT	4th Year	Capgemini	Yet to be decided
136	Sai Vivek Yeggadi	160115737109	IT	4th Year	Capgemini	Yet to be decided
137	Navya Gunti	160115736006	Mechanical	4th Year	Capgemini	Yet to be decided
138	Krishna sai vadapally	160115736089	Mechanical	4th Year	Capgemini	Yet to be decided
139	K Vihar	160115733178	CSE	4th Year	Caravel. AI	25,000
140	Rishi Vishwanadhan	160115805050	Bio-Tech	4th Year	CCMB	30,000
141	Mani Deepika Mallavarapu	160115805010	Bio-Tech	4th Year	CCMB	25,000
142	Himanshu Ketan Kapashi	160115733157	CSE -3	4th Year	Code Mani Green Tech Solutions	16.500
143	Rizwana Shaik	160115805030	BIO-Tech	4th Year	Cognizant	12,000
144	Tirumalasetty Vijay	160115802050	Chemical	4th Year	Cognizant	12,000
145	Akhil Konegari	160115732084	Civil	4th Year	Cognizant	12,000
146	Kolishetty Mahesh	160115732095	Civil	4th Year	Cognizant	12,000
147	Pallavi Byagari	160115733008	CSE	4th Year	Cognizant	12,000
148	Akhila Sirikonda	160115733001	CSE	4th Year	Cognizant	12,000
149	Keerthi Sanke	160115733004	CSE	4th Year	Cognizant	12,000
150	Monica K.	160115733006	CSE	4th Year	Cognizant	12,000
151	Shambhavi M	160115733014	CSE	4th Year	Cognizant	12,000

152	Shreya Therupally	160115733016	CSE	4th Year	Cognizant	12,000
153	Aravind Babu Somarapu	160115733023	CSE	4th Year	Cognizant	12,000
154	Hari Challa	160115733029	CSE	4th Year	Cognizant	12,000
155	Hemanth Reddy	160115733031	CSE	4th Year	Cognizant	12,000
156	Ithesh Muppaneni	160115733032	CSE	4th Year	Cognizant	12,000
157	Sai Allala	160115733049	CSE	4th Year	Cognizant	12,000
158	SRINATH TANGALLAPALLY	160115733056	CSE	4th Year	Cognizant	12,000
159	SRUJANVESH GOUD KOTHA	160115733057	CSE	4th Year	Cognizant	12,000
160	Aakanksha Vinnakoti	160115733061	CSE	4th Year	Cognizant	12,000
161	Thota Jyothi	160115733070	CSE	4th Year	Cognizant	12,000
162	shefali shireen	160115733075	CSE	4th Year	Cognizant	12,000
163	ABRAR ATHAR HASHMI	160115733082	CSE	4th Year	Cognizant	12,000
164	Harish Kumar Kathi	160115733087	CSE	4th Year	Cognizant	12,000
165	Praneeth Kumar Sajulu	160115733099	CSE	4th Year	Cognizant	12,000
166	Alekya Gujjala	160115733121	CSE	4th Year	Cognizant	12,000
167	Komal Puranik	160115733127	CSE	4th Year	Cognizant	12,000
168	Rachana Kavukuntla	160115733134	CSE	4th Year	Cognizant	12,000
169	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	Cognizant	12,000
170	Dileep Matha	160115733153	CSE	4th Year	Cognizant	12,000
171	Madhukar Domakonda	160115733159	CSE	4th Year	Cognizant	12,000
172	Uma Maheshwara Swamy D	160115733177	CSE	4th Year	Cognizant	12,000
173	Sharon Keerthana Chiluvuri	160115735021	ECE	4th Year	Cognizant	12,000
174	Suchithra Reddy Yellolu	160115735026	ECE	4th Year	Cognizant	12,000
175	Supraja Paloju	160115735027	ECE	4th Year	Cognizant	12,000
176	Abhilash Reddy Devarinti	160115735033	ECE	4th Year	Cognizant	12,000
177	Anil kumar	160115735035	ECE	4th Year	Cognizant	12,000
178	Raghuram Chepuri	160115735049	ECE	4th Year	Cognizant	12,000
179	Sarparapu Divya Sri	160115735066	ECE	4th Year	Cognizant	12,000
180	Goutham Sadubathula	160115735092	ECE	4th Year	Cognizant	12,000
181	Methuku Mohan Kumar	160115735099	ECE	4th Year	Cognizant	12,000
182	Liji p Jose	160115735126	ECE	4th Year	Cognizant	12,000
183	Poojitha Borra	160115735129	ECE	4th Year	Cognizant	12,000
184	baswa sairama amulya	160115735134	ECE	4th Year	Cognizant	12,000
185	K Sampangi Tejaswini	160115735135	ECE	4th Year	Cognizant	12,000
186	Ulligadda sreeja	160115735137	ECE	4th Year	Cognizant	12,000
187	Amit Anchaliya	160115735142	ECE	4th Year	Cognizant	12,000
188	Nikhil Madhunala	160115735152	ECE	4th Year	Cognizant	12,000
189	Latha Gunja	160115735322	ECE	4th Year	Cognizant	12,000
190	BHAGYA SRI G	160115734003	EEE	4th Year	Cognizant	12,000

191	HARITHA RACHURI	160115734005	EEE	4th Year	Cognizant	12,000
192	SHIVAPRIYA CHADA	160115734014	EEE	4th Year	Cognizant	12,000
193	SRINIJA REDDY KAMATHAM	160115734018	EEE	4th Year	Cognizant	12,000
194	VAISHNAVI AVADHANAM	160115734022	EEE	4th Year	Cognizant	12,000
195	AKASH GUNTI	160115734026	EEE	4th Year	Cognizant	12,000
196	Jay Panara	160115734087	EEE	4th Year	Cognizant	12,000
197	Sai Teja Medepalli	160115734103	EEE	4th Year	Cognizant	12,000
198	Srinagh dhanunjai Chalasani	160115734112	EEE	4th Year	Cognizant	12,000
199	Anjani Durisety	160115737004	IT	4th Year	Cognizant	12,000
200	Bhavitha Maile	160115737008	IT	4th Year	Cognizant	12,000
201	Hari Priyanka SA	160115737012	IT	4th Year	Cognizant	12,000
202	pragna challa	160115737019	IT	4th Year	Cognizant	12,000
203	Dheeraj Reddy Jambula	160115737039	IT	4th Year	Cognizant	12,000
204	Pravin Kishore Koyalkar	160115737048	IT	4th Year	Cognizant	12,000
205	Vasudeva Gudimalla	160115737058	IT	4th Year	Cognizant	12,000
206	Vishal Anand Chenna	160115737059	IT	4th Year	Cognizant	12,000
207	Deepika Bomma	160115737064	IT	4th Year	Cognizant	12,000
208	Sai Rishitha Gorantla	160115737072	IT	4th Year	Cognizant	12,000
209	B. Shreeshma	160115737076	IT	4th Year	Cognizant	12,000
210	Hemanth Reddy Loka	160115737096	IT	4th Year	Cognizant	12,000
211	Sai kiran Chavan	160115737106	IT	4th Year	Cognizant	12,000
212	Sai Shashank Veesam	160115737108	IT	4th Year	Cognizant	12,000
213	Sanjeev Kumar DUMPALA	160115737111	IT	4th Year	Cognizant	12,000
214	Vivek Kumar Reddy H	160115737118	IT	4th Year	Cognizant	12,000
215	Yatish Chandra	160115737119	IT	4th Year	Cognizant	12,000
216	Kiran Kumar Chirra	160115737301	IT	4th Year	Cognizant	12,000
217	SONI MALKAPURAM	160115737317	IT	4th Year	Cognizant	12,000
218	Akhil Kandaloju	160115736016	Mech	4th Year	Cognizant	12,000
219	Rishi Teja Madduri	160115736034	Mech	4th Year	Cognizant	12,000
220	Vimmigari Sanjay kumar	160115736040	Mech	4th Year	Cognizant	12,000
221	Yashwanth Reddy Addula	160115736060	Mech	4th Year	Cognizant	12,000
222	Sathola Anand	160115736077	Mech	4th Year	Cognizant	12,000
223	HARSHITH BH	160115736086	Mech	4th Year	Cognizant	12,000
224	Tejasai Naredla	160115736113	Mech	4th Year	Cognizant	12,000
225	ALLU VENKATA SAI KUMAR	160115736303	Mech	4th Year	Cognizant	12,000
226	Srujan Alladurgam	160115738052	Prod	4th Year	Cognizant	12,000
227	Merugu nikhil Goud	160115735151	ECE	4th Year	CoreCompete	Performance based
228	Imran Mohammed	160115734092	EEE	4th Year	CoreCompete	Performance based
229	Mohammad SameeR	160115736029	Mechanical	4th Year	CoreCompete	Performance based

230	Nyalam Mahesh	160115736091	Mechanical	4th Year	CoreCompete	Performance based
231	Tadi Pavan Kumar	160115735048	ECE	4th Year	Corporatz	Performance based
232	Ravali.D	160115737068	IT	4th Year	Corporatz	Performance based
233	Ashwini	160115737319	IT	4th Year	Corporatz	Performance based
234	Veerabathini Anirudh Priyatham	160115737092	IT	4th Year	Corporatz	Performance based
235	Roshini P	160115737070	IT	4th Year	Corporatz	Performance based
236	Ujwal Dasari	160115737056	IT	4th Year	Corporatz	Performance based
237	Vinona	160115737083	IT	4th Year	Corporatz	Performance based
238	Ananya Veer	160115737089	IT	4th Year	Corporatz	Performance based
239	Adhokshaj Vemavarapu	160115737088	IT	4th Year	Corporatz	Performance based
240	Chikula Saikumar	160115733107	CSE2	4th Year	CtrlS Datacenters	10,000
241	Sonu Badugu	160115733055	CSE	4th Year	DarwinBox	15,000
242	Nisha Reddy	160115735069	ECE	4th Year	DarwinBox	15,000
243	Naga Rama Bhadra Kumar Malladi	160115733036	CSE	4th Year	Delhivery	25,000
244	Pavan Sai Ganji	160115733040	CSE	4th Year	Delhivery	25,000
245	Manoj kumar Badalgama	160115733093	CSE	4th Year	Delhivery	25,000
246	Chandrahas Reddy Mandapati	160115737037	IT	4th Year	Delhivery	25,000
247	Venkatesh Elaboina	160115733118	CSE	4th Year	EZE Software	20,000
248	Sree Hari Priya Bellam	160115733147	CSE	4th Year	GE Appliances	20,000
249	Monica K	160115733006	CSE	4th Year	GE Appliances	20,000
250	Jagannath Saragadam	160115737050	IT	4th Year	GE Appliances	20,000
251	Veeramreddy Sai Tejaswi	160115737024	IT	4th Year	GE Appliances	20,000
252	N.Rahul Chandra	160115733043	CSE	4th Year	Gemini Consulting	10,000
253	Samhita Alla	160115733013	CSE	4th Year	Gradvine	10,000
254	Sai Revannth Vedala	160115733050	CSE	4th Year	IBM	30,000
255	Apoorva ventrapragada	160115737006	IT	4th Year	IBM	30,000
256	Ram Ananya Tenneti	160115735104	ECE2	4th Year	IIIT Hyderabad	Yet to be decided
257	M/s P Hema Latha (Tech Apprentice)	160115735315	ECE2	4th Year	Indian Oil Corpn	17,000
258	Sravya Chowderpally	160115733146	CSE	4th Year	JPMC	27,500
259	Kanaparthi Vineeth Rao	160115733119	CSE	4th Year	JPMC	27,500
260	Anjani Vaddepally	160115733064	CSE	4th Year	JPMC	27,500
261	M.Ashvik	160115733086	CSE	4th Year	JPMC	27,500
262	Krishna Sri Somepalli	160115733128	CSE	4th Year	JPMC	27,500
263	Jella Nikhil Babu	160115733160	CSE	4th Year	JPMC	27,500
264	B Rohith reddy	160115733103	CSE	4th Year	JPMC	27,500
265	Kunda Rama Krishna	160115733162	CSE	4th Year	JPMC	27,500
266	R.Sahithi	160115733123	CSE	4th Year	JPMC	27,500
267	Harsh Rathi	160115733030	CSE	4th Year	JPMC	27,500
268	Richa Kulkarni	160115733137	CSE	4th Year	JPMC	27,500

269	Siddharth panday	160115737053	CSE	4th Year	JPMC	27,500
270	Shaik Roshna	160115735075	ECE	4th Year	JPMC	27,500
271	Vishnu Rohith Karanam	160115737060	IT	4th Year	JPMC	27,500
272	Sneha Reddy	160115737079	IT	4th Year	JPMC	27,500
273	V.Nikita	160115737018	IT	4th Year	JPMC	27,500
274	Ch. Sai Spandana	160115737023	IT	4th Year	JPMC	27,500
275	Shravya Sheela	160115737027	IT	4th Year	JPMC	27,500
276	Suraj	160115737115	IT	4th Year	JPMC	27,500
277	Pranavi Reddy	160115732010	Civil	4th Year	Karvy	10,000
278	Naveen Kumar Kandraju	160115733329	CSE	4th Year	Karvy	10,000
279	B.Mounika	160115733181	CSE	4th Year	Karvy	10,000
280	bhongiri tejaswi	160115733312	CSE	4th Year	Karvy	10,000
281	D.Devendranath	160115733028	CSE	4th Year	Karvy	10,000
282	Pranuthi kota	160115735312	ECE	4th Year	Karvy	10,000
283	Soumith Peketi	160115737054	IT	4th Year	Karvy	10,000
284	Nitya Ingale	160115737312	IT	4th Year	Karvy	10,000
285	Annam Chakravarthy	160115737036	IT	4th Year	Karvy	10,000
286	K VENKATADASU	160115737302	IT	4th Year	Karvy	10,000
287	Pavansai cherukuri	160115737047	IT	4th Year	Karvy	10,000
288	M Abhishek	160115737032	IT	4th Year	Karvy	10,000
289	Manish Kumar sadhu	160115733092	CSE	4th Year	Merilytics	20,000
290	Shreya Therupally	160115733016	CSE	4th Year	Merilytics	20,000
291	Butharaju Sravya	160115733076	CSE	4th Year	Merilytics	20,000
292	Madhurima Yella	160115733131	CSE	4th Year	Merilytics	20,000
293	Faraaz Ahmed	160115733155	CSE	4th Year	Merilytics	20,000
294	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	Merilytics	20,000
295	Rashmi Kapoor	160115734071	EEE	4th Year	Merilytics	20,000
296	Srikesh Pulluri	160115734111	EEE	4th Year	Merilytics	20,000
297	Bhavitha Maile	160115737008	IT	4th Year	Merilytics	20,000
298	N VENKATA SAI DHEERAJ	160115733117	CSE	4th Year	NCR	Yet to be decided
299	Abdul Wahed	160115733079	CSE	4th Year	NCR	Yet to be decided
300	Nikitha Krishna.V	160115733073	CSE	4th Year	NCR	Yet to be decided
301	D. Avanthika Shree	160115733065	CSE	4th Year	NCR	Yet to be decided
302	Ravi Chandran Reddy Kallem	160115733102	CSE	4th Year	NCR	Yet to be decided
303	S Harsha Vardhan Rao	160115733326	CSE	4th Year	NCR	Yet to be decided
304	Sahithi Reddy	160115733138	CSE	4th Year	NCR	Yet to be decided
305	Vangari Pallavi	160115733133	CSE	4th Year	NCR	Yet to be decided
306	Padala soumya	160115733145	CSE	4th Year	NCR	Yet to be decided
307	Shravanthi Mv	160115735084	ECE	4th Year	NCR	Yet to be decided

308	MEGHNA RAMAN	160115735127	ECE	4th Year	NCR	Yet to be decided
309	A. Ravi Teja	160115735107	ECE	4th Year	NCR	Yet to be decided
310	Sharanya Gandla	160115735020	ECE	4th Year	NCR	Yet to be decided
311	Soumya Sajja	160115735024	ECE	4th Year	NCR	Yet to be decided
312	Tanishka Vegunta	160115737080	IT	4th Year	NCR	Yet to be decided
313	pratik saxena	160115737102	IT	4th Year	NCR	Yet to be decided
314	Aditya Kuppa	160115733116	CSE	4th Year	Oracle	35,000
315	Thummala Anish Reddy	160115733085	CSE	4th Year	Oracle	35,000
316	Sagi Sai Nithish Varma	160115733167	CSE	4th Year	Oracle	35,000
317	Mothe Ajay	160115737315	IT	4th Year	PH Technolgies	8,000
318	Koushik Gadpale	160115737042	IT	4th Year	PH Technolgies	8,000
319	Anusha Gajja	160115737063	IT	4th Year	PH Technolgies	8,000
320	Sri Keerthi Reddy	160114732010	CIVIL	4th Year	Premier Developers	10,000
321	Usama bin Faheem	160115732058	CIVIL	4th Year	Premier Developers	10,000
322	Pranavi Reddy	160115732010	CIVIL	4th Year	Premier Developers	10,000
323	Altamash Siddiqui	160115732035	CIVIL	4th Year	Premier Developers	10,000
324	S. Spandana	160115732309	CIVIL	4th Year	Premier Developers	10,000
325	Akshay Kumar	160115736017	Mechanical	4th Year	Premier Developers	10,000
326	Lunavath Divya	160115736322	Mechanical	4th Year	Premier Developers	10,000
327	Praveen Gitta	160115736317	Mechanical	4th Year	Premier Developers	10,000
328	Shreshta Mahankali	160115736072	Mechanical	4th Year	Premier Developers	10,000
329	G Manasa	160115736066	Mechanical	4th Year	Premier Developers	10,000
330	Supriya Ponna	160115738010	Production	4th Year	Premier Developers	10,000
331	V Sai Teja	160115738048	Production	4th Year	Premier Developers	10,000
332	Y V Sai Bhavana	160115738006	Production	4th Year	Premier Developers	10,000
333	Mitesh Loya	160115738025	Production	4th Year	Premier Developers	10,000
334	Zeeshan	160115738027	Production	4th Year	Premier Developers	10,000
335	Sunayana	160115738008	Production	4th Year	Premier Developers	10,000
336	prapul reddy	160115738036	Production	4th Year	Premier Developers	10,000
337	mallikarjun Reddy	160115738024	Production	4th Year	Premier Developers	10,000
338	K Aneesha	160115738002	Production	4th Year	Premier Developers	10,000
339	Neha Fahreen	160116000000	CSE	4th Year	qualcomm	30,000
340	Hajirah Tabassum Shaik	160115733144	CSE	4th Year	qualcomm	30,000
341	Adithi Reddy	160115735121	ECE	4th Year	qualcomm	30,000
342	Krishna Sri Somepalli	160115733128	CSE	4th Year	Samsung R&D	35,000
343	Bala Lakshmi Sai Sweta Sahithi Ramaraju	160115733123	CSE	4th Year	Samsung R&D	35,000
344	Anjani Vadepally	160115733064	CSE	4th Year	Samsung R&D	35,000
345	Sree Hari Priya Bellam	160115733147	CSE	4th Year	Samsung R&D	35,000
346	Susmitha Dhadige	160115733149	CSE	4th Year	Samsung R&D	35,000

347	D. Avanthika Shree	160115733065	CSE	4th Year	Samsung R&D	35,000
348	Samhita Alla	160115733013	CSE	4th Year	Samsung R&D	35,000
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351	Shreya Therupally	160115733016	CSE	4th Year	Samsung R&D	35,000
352	B. Pallavi	160115733008	CSE	4th Year	Samsung R&D	35,000
353	Koti Mahitha	160115733333	CSE	4th Year	Samsung R&D	35,000
354	Varalakshmi Vakkalagadda	160115737081	IT	4th Year	Samsung R&D	35,000
355	Nihitha Veeramachaneni	160115737067	IT	4th Year	Samsung R&D	35,000
356	Siddharth Gupta	160115733173	CSE	4th Year	ServiceNow	25,000
357	Apoorva Ventrapragada	160115737006	IT	4th Year	ServiceNow	25,000
358	Koyalkar Pravin Kishore	160115737048	IT	4th Year	TCS	15,000
359	Tayyala Sheshu	160115735113	ECE	4th Year	Veda IT	10,000
360	Nikhil Gattu	160115735101	ECE	4th Year	Veda IT	10,000
361	SAI NIRANJAN KARTHIK M	160115735165	ECE	4th Year	Veda IT	10,000
362	Jaya Maheedhar Manthripragada	160115735145	ECE	4th Year	Veda IT	10,000
363	Bachu Naveen Kumar	160115735100	ECE	4th Year	Veda IT	10,000
364	M.Nikhil	160115735152	ECE	4th Year	Veda IT	10,000
365	CS Priyanka	160115735074	ECE	4th Year	Veda IT	10,000
366	A SHIVA KRISHNA	160115735168	ECE	4th Year	Veda IT	10,000
367	Bindu Devalla	160115735065	ECE	4th Year	Veda IT	10,000
368	AKHIL SABBANI	160115735141	ECE	4th Year	Veda IT	10,000
369	Charita Dontireddy	160115733067	CSE	4th Year	Verisk Analytics	25,000
370	Neha Farheen	160115733132	CSE	4th Year	Verisk Analytics	25,000
371	Butharaju Sravya	160115733076	CSE	4th Year	Wells Fargo	25,000
372	ABRAR ATHAR HASHMI	160115733082	CSE	4th Year	Wells Fargo	25,000
373	Kannuri Ajay	160115733020	CSE	4th Year	Wells Fargo	25,000
374	Neha Komuravelly	160115733007	CSE	4th Year	Wells Fargo	25,000
375	Ramesh Rohith	160115735157	ECE	4th Year	Wells Fargo	25,000
376	Amit kumar	160115735142	ECE	4th Year	Wells Fargo	25,000
377	B .SAI CHARAN	160115735159	ECE	4th Year	Wells Fargo	25,000
378	Manasa vugge	160115734009	EEE	4th Year	Wells Fargo	25,000
379	Koyalkar Pravin Kishore	160115737048	IT	4th Year	Wells Fargo	25,000
380	Jyothsna	160115737014	IT	4th Year	Wells Fargo	25,000
381	Naga Akhil Belide	160115737100	IT	4th Year	Wells Fargo	25,000
382	Pragna challa	160115737019	IT	4th Year	Wells Fargo	25,000

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a student of Chaitanya Bharati Institute of Technology

Subject B.Tech (Chemical) has completed Training / Project Work in this Organisation from 12.06.2018 to 11.07.2018 on the topic "Zirconium Oxide Production & Experimental Study on Filtration & Evapolation of Sodium Nitrate along with Evapolator Design for the Process"

His / Her conduct during the training period has been good / satisfactory.

13-7-2018

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S. No: DW0771

Date: 02nd July, 2019

Certificate of Dissertation Work

This is to certify that **Mr. V. Vinay Rao** has carried out his dissertation work as part of B.Tech (Chemical Engineering) course at CSIR-IICT, Hyderabad under the supervision of **Dr. A. Venugopal** in the department of **Catalysis & Fine Chemicals** during the period **17th May 2019** to **30th June 2019.**

Project Title: *Synthesis and characterization of modified Ni based catalysts for CO_x free hydrogen production by CH_4 cracking*

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Influence of Temperature on Tensile Properties and Fracture Behavior of High Strength Stainless Steel

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Abstract - *The history of steel dates back to the 17th century and has been instrumental in the betterment of every aspect of our lives ever since, from the pin that holds the paper together to the reinforcement in the construction industry. Path breaking improvements in manufacturing techniques, access to advanced machinery and understanding of factors like heat treatment, corrosion resistance have aided in the advancement in the properties of steel in the last few years. In this research the results of a study aimed at the influence of temperature on tensile fracture behavior of stainless steel 2304 is discussed. The microstructure of the as received steel was examined and characterized for the nature and morphology of the grains and the presence of other intrinsic features in the microstructure. The tensile tests were done on a fully automated closed-loop servo-hydraulic test machine at room temperature as well as elevated temperature. The failed samples of high strength steels were examined in a scanning electron microscope for understanding the fracture behavior. The factors contributing to failure are briefly discussed in light of the conjoint and mutually interactive influences of intrinsic microstructural effects.*

Key Words: Duplex Stainless Steel, Tensile Strength, Fracture Behaviour, Damage analysis.

1. INTRODUCTION

In the domain encompassing materials, science and engineering, high cycle fatigue has been defined to be the end result of progressive, localized, and permanent structural damage that often occurs when a material and/or structure is subjected to tensile stress and cyclic fatigue [1]. In actual practice, two aspects of the fatigue properties of a material must be considered. These are, (a) fatigue life, and (b) fatigue crack growth behavior. In this research study, preliminary experiments were conducted with the primary objective of understanding the influence of test temperature on tensile behavior of a high strength stainless steel. Test specimens of the chosen stainless steel were deformed at ambient temperature and an elevated temperature. The elevated temperature chosen was 205^0C. The results are analyzed and fractographic observation of the fracture surface was used to provide an understanding of the microscopic mechanisms governing the fracture.

2. LITERATURE REVIEW

2.1 Background

The gathering of metals based entirely on compositions, which includes the family of stainless steels initiated way back in 1913 in the city of Sheffield, England. Harry Brierley was attempting various combinations and as could be expected he noticed that the specimens while being cut during one of these trials failed show evidence of rusting and were also found hard to carve. Upon further exploration of this curious metal he found that it contained around 13% chromium. This was immediately classified as stainless steel. This unique property offered by stainless steel led to its selection and use purposes of cutlery. It was cutlery made from stainless steels that eventually made the company based in Sheffield very popular. At around the same time sustained advances were being made in France in the domain spanning steels, which culminated in the development and emergence of austenitic stainless steels. As of this date, the overall utilization of stainless steel is continuing to grow in industries [2].

2.2 The Family of Steels

Stainless steels are iron-based compounds containing around 10.5% chromium. This does result in a defensive self-mending oxide film, which is the primary motivation behind why this class of steels has been given the trademark "stainlessness". The capacity of the thin oxide layer to mend itself implies that this steel is safe against corrosion regardless of the severity of the surrounding environment and the extent of corrosion on the surface. This is not the situation when carbon steels or low amalgam steels are shielded from consumption using either metallic coatings made of zinc or cadmium, or by the use of natural coatings, such as paint [4]. Although every stainless steel relies upon the use of chromium, other alloying elements are also regularly added with the primary purpose of achieving a better combination of properties. Depending upon the exact chemical composition, the family of stainless steels can be broadly classified to be the following: (i) Austenitic Stainless steels, (ii) Ferritic Stainless Steels, (iii) Martensitic Stainless Steels, (iv) Duplex Stainless steels, and (v) Precipitation hardening stainless steels [3].

2.3 Characteristics of Stainless Steel

The overall characteristics of the family of stainless steels in comparison with the family of carbon steels are essentially the following [4]:
(a) High work hardening rate
(b) Good ductility
(c) High strength and hardness
(d) Improved strength at elevated temperatures
(e) Good corrosion resistance
(f) Improved toughness at cryogenic temperatures
(g) Lower magnetic response (for the family of austenitic stainless steels)
(h) Can retain a corrosion resistant surface in the finished product.

2.4 Stainless Steel as Reinforcement for Civil Construction Industry

Stainless steel is chosen for its corrosion resistance, strength and long life. The increase in cost arising from utilizing stainless steel as strengthening bars in concrete ranges from one to fifteen percent depending upon overall complexity of the structure. At a point when Life Cycle Cost and a longer life for the reinforcing bar, up to 125 years, occurs then stainless steel is a financially effective choice as reinforcing material. Stainless steels offer either the same or even higher strength than carbon steel, depending on the alloy chosen. The chosen stainless steel compositions have natural corrosion resistance and improved resistance to pitting corrosion, crevice corrosion, and even stress corrosion cracking. The group of elements can even be effectively framed into 3-D twists, if required, welded and made accessible in attractive and non-magnetic alloy compositions while offering the attributes of both high and low temperature strength [5].

2.5 Tensile and Fatigue Behavior of Stainless Steel

E.S Puchi-Cabrera and co-workers [6], published their research findings on the fatigue behavior of an AISI 316L stainless steel coated with a PVD titanium nitride (TiN) deposit and concluded that coating a 316L stainless steel with TiN offered a substantial improvement in fatigue properties in comparison with the uncoated substrate. The increase in fatigue life was found to be significantly dependent on the magnitude of alternating stress applied to the material. At a low maximum alternating stress (460 MPa) the observed improvement in fatigue life was as high as 2119%, whereas, at a higher value of the maximum alternating stress (510 MPa) an increase in fatigue life of up to 400% was achieved. The fatigue limit increased by 22%. There was no substantial increase in yield strength of the coated material.

K.K.Ray and co-workers [7], studied the influence of mean stress on fatigue damage of AISI 304 LN stainless steel. They conducted a series of fatigue experiments on 304LN stainless steel, using stress-control mode, for a number of combinations of mean stress and stress amplitude. They observed the extent of strain accumulation in the selected AISI 304LN stainless steel to increase with an increase in magnitude of the peak stress of imposed cyclic loading. The magnitude of strain accumulation was found to be only marginal when the tests were carried out under symmetric loading, but its magnitude was considerable when the tests were done under asymmetric loading, despite the mean stress being positive or negative. When magnitude of the mean stress was kept constant, the number of cycles to cause fatigue failure (Nf) decreased with an increase in amplitude of the alternating stress.

H. Nishi and co-workers [8], studied the fatigue behavior on weldment of austenitic stainless steel for use in the ITER vacuum vessel. Locations of incomplete penetrations (IP) behaved and propagated as a crack. Most of total fatigue life for the weldment was predominantly time spent in crack propagation. The crack propagation rates of the weldment were very much in accordance with those of the weld metal. The fatigue lives were estimated using fracture mechanics principles based on crack propagation rates of the weld metal. The fatigue strength of the weldment was found to be noticeably lower than that of the smooth specimen. The effect of incomplete penetration (IP) on fatigue strength of the weldment is serious problem even if the IP is small.

M.F. Buchely and co-workers [9], studied the effect of shielded metal arc welding (SMAW) manufacturing process on high-cycle fatigue of AISI 304 base metal using AISI 308L filler metal. They concluded the microstructure of the weld deposits to be austenitic stainless steel and retained ferrite to be both in ventricular and lathy morphology. The dendrite arm spacing was found to be smaller for specimens that used a “high” heat input during welding. It was found that a higher ferrite number (FN) was responsible for lower hardness of the weld deposits. The modified Goodman criterion was found to work well for the conditions studied. It was found that at a “low” heat input the deposits offered the highest resistance to high-cycle fatigue.

M. Topic and co-workers [10], published their research findings on the effect of cold work and heat treatment on the fatigue behavior of 3CR12 corrosion resistant steel wire. The mechanical properties of 3CR12 steel wire was found to increase with increased drawing strain. Further, the drawing strain increased the fatigue limit of initially annealed 3CR12 steel wire for both the smooth and notched test samples. An application of the cold drawn 3CR12 steel wire was limited to low stress fatigue conditions. Drawing of quenched 3CR12 steel was significantly improved and much easier to achieve when compared to drawing of 3CR12 steel that had an initial annealed microstructure. Quenching and successive drawing did contribute to improving the fatigue strength. The dual-phase microstructure had a significant benefit in terms of fatigue behavior; it delayed crack initiation and retarded crack propagation. A noticeable change in fatigue fracture mode, from predominantly transgranular to brittle, was a major limiting factor for the application of quenched-drawn 3CR12 steel wires when the cyclic stresses were higher than 15% of the fatigue limit.

Zahida begum and co-workers [11], studied the tensile and corrosion fatigue behavior of austenitic stainless steels. They found Type 304 stainless steel to possess the highest yield strength and ultimate tensile strength, and resultant lower ductility. The other steels ranked in order of decreasing yield strength and tensile strength, and increased ductility were Type 316LN stainless steel, Type 316 stainless steel and Type 316L stainless steel. Fractographic studies revealed corrosion fatigue cracking to be wholly transgranular for all of the steels. For all the steels, transgranular cracking of austenite was evident at mean stress values of 200 MPa and 250 MPa. No visibly distinct striations were observed. At lower values of mean stress (100 MPa and 150 MPa), fine striations were observed in all the stainless steels examined.

Stainless steel is a good corrosion resistant material. Corrosion is one of the major problems in construction Industry. Over twenty six percent of the bridges in the United States are structurally deficient or functionally obsolete. Corrosion of steel used in structures like bridges and buildings is a problem that has gained increased interest and focused concern [13-17].

3. THE MATERIAL CHOSEN

3.1 Material

The material chosen for this study was the Duplex Stainless Steel 2304 supplied by Salit Specialty Rebar. The chemical composition of this steel is provided in Table 3.1. Presence of carbon provides not only solid solution strengthening but also hardenability through the formation and presence of alloy carbides in the microstructure. The presence of elements like chromium [Cr] assists in both the formation and presence of carbide particles, which contributes to enhancing strength of the steel matrix. However, the presence and distribution of carbide particles in the microstructure is detrimental to fracture toughness or impact resistance arising as a consequence of increasing the number of potential sites for initiation of fine microscopic cracks. Presence of nickel [Ni] facilitates in lowering the transition temperature while simultaneously enhancing toughness and stabilizing any austenite that is present in the material [12].

Table -3.1: Nominal chemical composition of Stainless Steel 2304 (Weight Percent)

Material	Fe	Cr	Ni	Mn	Si	Cu	Mo	N	P	C	B	S
2304 Stainless Steel	70.55	22.84	3.64	1.72	0.46	0.31	0.26	0.17	0.02	0.02	.002	.001

3.2 Test Specimen Preparation

Full length rebar's made of duplex stainless steel are often chosen for use potentially viable reinforcements for reinforced concrete structures. The rebar was cut into small pieces, each of size 2.5 inches, as shown in Figure 3.1. The cut samples were sent to a professional machining facility based in Pennsylvania for the purpose of machining in conformance with standards specified in ASTM E-8, as shown in Figure 3.2. The machined test final specimen is shown in Figure 3.3.

Fig -3.1: Rebar cut pieces before machining to desired shape

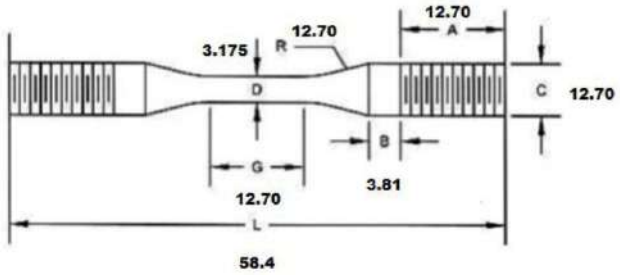

Fig -3.2: A schematic of the cylindrical test specimen used for mechanical testing

Fig -3.3: Typical specimen after machining

4. EXPERIMENTAL PROCEDURES

4.1 Initial Microstructure Characterization

An initial characterization of the micro-structure of the as-provided material was done using a low magnification optical microscope. Samples of required size were cut from the as-received material, which is stainless steel 2304 and mounted in epoxy and polished using a series of silicon carbide impregnated emery paper having different grit size of 240-grit, 320-grit, 400-grit and 600-grit using copious amounts of water both as a lubricant and coolant. Subsequently, the steel sample was mechanically polished using five-micron alumina powder suspended in distilled water. Fine polishing to a perfect mirror-like finish of the surface was achieved using a solution of one-micron alumina powder suspended in distilled water as the lubricant. Subsequent to polishing, the sample was subsequently

etched using a reagent, that is a solution mixture of 16.67 pct. Hydrochloric acid (HCl) and 83.33 pct. distilled water (H2O). In other words, 200 ml of HCl for 1000 ml of H2O. This is termed as Beraha's tint etch. The surface of the steel sample which was polished and etched was then observed in an optical microscope and photographed using standard bright field illumination technique, shown in the Figure 4.1.

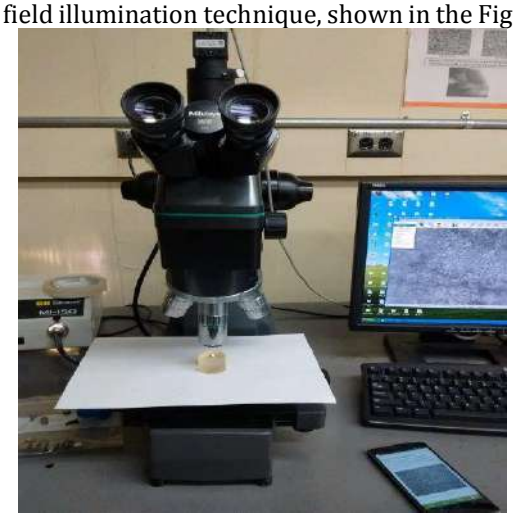

Fig -4.1: Low magnification optical microscope for examining microstructure

4.2 Tensile Tests

Uniaxial tests were conducted on an INSTRON-8500 plus, a closed loop, fully automated servo-hydraulic mechanical test machine, using a 100 KN load cell. The tests were performed both at room temperature and at an elevated temperature in the laboratory air environment [Relative Humidity of 55%]. Test samples of the chosen steel were deformed at a constant strain rate of 0.0001/sec. An axial 12.5mm gage length clip on extensometer was attached to the test sample, utilizing rubber bands for tests at room temperature and steel springs for tests at the elevated temperature, to provide a measure of strain during uniaxial stretching. The stress and strain measurements, parallel to the load line, were recorded on a PC–based data acquisition system (DAS).

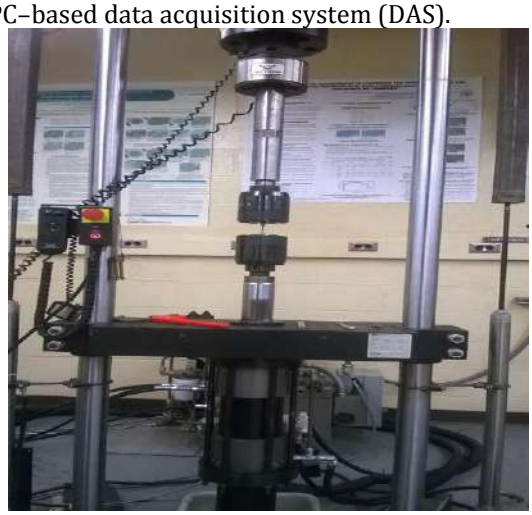

Fig -4.2: Test setup for tensile testing at room temperature

Fig -4.3: Test setup for tensile testing at 205^0C

4.3 Failure Damage Analysis

Fracture surfaces of the deformed and failed tensile specimens were examined in a scanning electron microscope (SEM). This was done to help establish the macroscopic fracture mode while concurrently characterizing the fine-scale features on the fracture surface so as to help establish the microscopic mechanisms governing fracture. The difference between macroscopic and microscopic fracture mechanisms is based entirely on the level of magnification at which the surface was observed and the micrographs taken. The overall nature of failure is referred to as the macroscopic mode while failure processes occurring at the local level are referred to as microscopic mechanisms. These mechanisms include the following: (i) microscopic void formation, (ii) microscopic void growth, and (iii) eventual coalescence to form one or more fine microscopic cracks. The microscopic cracks grow and coalesce to form macroscopic cracks.

5. RESULTS AND DISCUSSIONS

5.1 Initial Microstructure

The microstructure of the material chosen is an important factor to be taken into account in a study aimed at quantifying its properties. Properties spanning tensile strength, fracture toughness, fatigue resistance and resultant fracture behavior can be rationalized for purpose of its selection and use in a desired application. An optical micrograph of the longitudinal section of the as provided stainless steel 2304 is shown in the Figure 5.1. An optical micrograph of the transverse (T) section of the same stainless steel 2304 specimen is shown in Figure 5.2. The longitudinal (L) section reveals a mixture of light and dark regions. The light regions or islands can be categorized as pockets of ferrite (pure iron), while the darker or gray color regions are a mixture of very fine pearlite and austenite.

Also, the longitudinal (L) region revealed an absence of coarse second-phase particles at the allowable magnifications of the light optical microscope. The transverse (T) section of the as-provided material, i.e., stainless steel, reveals a healthy mixture of very fine grains. The light color regions or islands represent ferrite (or pure iron), while the darker regions represent a combination or mixture of pearlite and austenite. The presence and distribution of these micro-constituents is governed by a combination of composition and primary processing technique used to manufacture the as-provided steel. These microstructural features do exert an influence on tensile properties and cyclic fatigue behavior of the candidate steel.

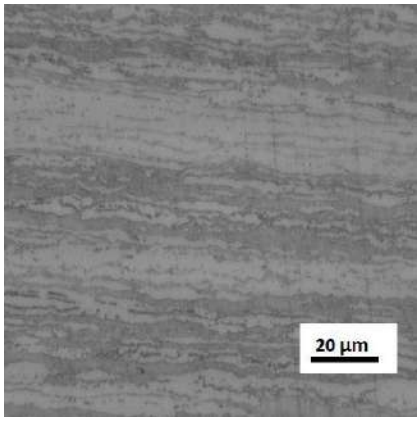

Fig -5.1: Optical micrograph showing key micro-constituents in the longitudinal section of specimen

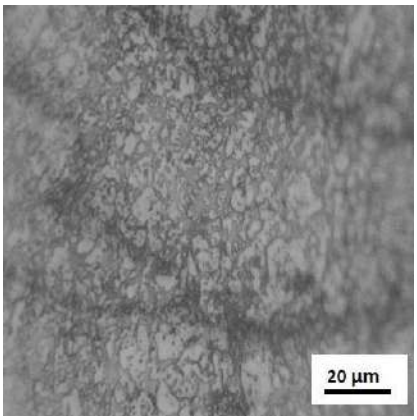

Fig -5.2: Optical micrograph showing key micro-constituents in the transverse section of specimen

5.2 Tensile Properties: Influence of Temperature

Tensile properties of the chosen material (Duplex stainless steel 2304), at both ambient temperature (27^{0}C) and elevated temperature (205 ^{0}C) are summarized in Table 5.3. Results reported are the mean values based on duplicate tests.

(i)The elastic modulus of the chosen steel was 242 GPa at room temperature and 222 Mpa at the elevated temperature of 205 ^{0}C, a nine percent decrease in elastic modulus as a consequence of increase in test temperature.

(ii) Yield strength of the stainless steel at room temperature was 648 MPa and at the elevated temperature 530 Mpa; a noticeable twenty percent decrease in strength with increase in test temperature.

(iii) The ultimate tensile strength (σUTS) at room temperature (27^{0}C) was 808 MPa and 718 Mpa at the elevated temperature (205 ^{0}C), an observable decrease in strength by 11 percent due to increase in test temperature.

(iv)The ductility, quantified by elongation-to-failure was 48.0% at room temperature (27^{0}C) and 40.0% at the elevated temperature (205 ^{0}C).

Table -5.3: A compilation of tensile properties at both room and elevated temperatures (Results are mean values)

Temperature	Elastic Modulus [GPa]	Yield Strength [MPa]	Tensile Strength [MPa]	Ductility [%]
27°C (82 F)	242	648	808	48.0
205°C (400 F)	222	530	718	40.0

5.3 Tensile Fracture Behavior

The tensile fracture surfaces of the chosen material (duplex stainless steel 2304) at both ambient temperature and elevated temperature were examined in a scanning electron microscope (SEM) to provide useful information relating to the specific role of intrinsic microstructural features and microstructural effects on strength, ductility and fracture properties of the candidate steel.

5.3.1 Tensile Fracture at Ambient Temperature

Scanning electron micrographs of the tensile fracture surface of the sample tested at ambient temperature revealed fracture to occur by the characteristic "cup and cone" type of separation, which is an indication of ductile fracture. The overall morphology is shown in Figure 5.3(a). High magnification observation of the fracture surface in the region of early damage initiation revealed in an array of fine microscopic voids and dimples. These features are clearly indicative of locally operating ductile failure mechanisms. This can be seen in Figure 5.3 (b). The fine microscopic cracks were surrounded by an observable population of microscopic voids and dimples, as shown in Figure 5.3(c). These fine features are indicative of "locally" brittle and ductile failure mechanisms. The region of overload revealed a sizeable population of microscopic voids inter-dispersed with shallow dimples (Figure 5.3 (d)), which is indicative of the occurrence of 'locally' ductile failure mechanism.

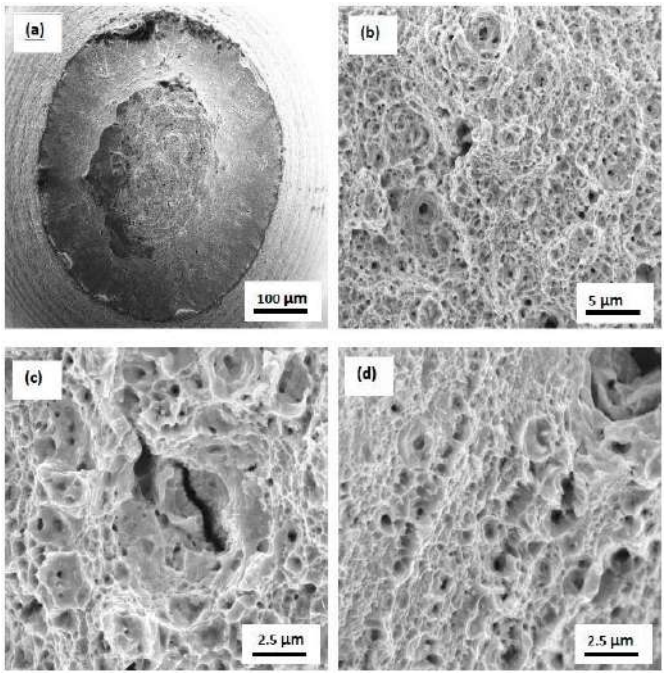

Fig -5.3: Scanning electron micrographs of the tensile fracture surface of stainless steel 2304 deformed at room temperature (27^{0}C), showing:
(a) Overall morphology of failure.
(b) High magnification observation of the region of early damage initiation inlaid with an array of fine microscopic voids and dimples, features indicative of locally ductile failure mechanisms.
(c) Fine microscopic cracks surrounded by an observable population of microscopic voids and dimples indicative of locally brittle and ductile failure mechanisms.
(d) A sizeable population of microscopic voids inter-dispersed with shallow dimples in the region of overload indicative of 'locally' ductile failure mechanism.

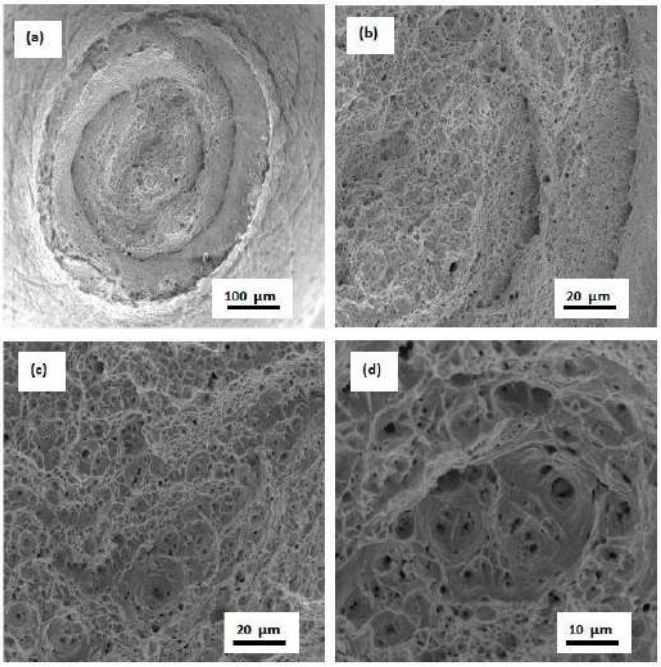

Fig -5.4: Scanning electron micrographs of the sample of stainless steel 2304 deformed in tension at an elevated temperature of 205^{0}C, showing:
(a) Overall morphology of failure revealing cup and cone morphology
(b) High magnification observation of (a) revealing dimples of varying size, isolated microscopic voids and macroscopic crack; features indicative of both brittle and ductile failure mechanism.
(c) A sizeable population of microscopic voids inter-dispersed with dimples, features indicative of 'locally' ductile failure mechanism.
(d) A population of voids of varying size and dimples covering the overload fracture surface.

5.3.2 Tensile Fracture at Elevated Temperature

Scanning electron microscopy observations of the sample of stainless steel 2304 deformed in tension at the chosen elevated temperature [205^{0}C], revealed the following observations. Overall morphology of failure was ductile as shown in Figure 5.4(a). The overall morphology was essentially cup and cone failure. High magnification observation of the fracture surface reveals many features. These features are a combination of dimples of varying size, isolated microscopic voids, and macroscopic cracks (Figure 5.4 (b)). These features are indicative of both brittle and ductile failure mechanisms acting at the fine microscopic level. Figure 5.4(c), a sizeable population of microscopic voids interdispersed with dimples can be seen. These features are indicative of 'locally' ductile failure mechanism. The overload fracture surface revealed a population of voids of varying size and dimples covering the fracture surface (Figure 5.4 (d)). These features are indicative of the occurrence of locally dominant ductile failure mechanisms.

6. CONCLUSIONS

Based on a preliminary study of microstructure and the role of test temperature in influencing tensile properties and fracture behavior of stainless steel 2304, following are the key observations or conclusions:

1. The longitudinal (L) section revealed a mixture of light and dark regions. The light regions or islands can be categorized as pockets of ferrite (pure iron), while the darker or gray color regions are a mixture of very fine pearlite and austenite. Also, the longitudinal (L) region revealed an absence of coarse second-phase particles at the allowable magnifications of the light optical microscope. The transverse (T) section of the as-provided material, i.e., stainless steel, revealed a healthy mixture of very fine grains. The light color regions or islands represent ferrite (or pure iron), while the darker

regions represent a combination or mixture of pearlite and austenite.

2. The presence and distribution of these micro-constituents is governed by a combination of composition and primary processing technique used to manufacture the as-provided steel. These microstructural features do exert an influence on tensile properties and cyclic fatigue behavior of the candidate steel.
3. The elastic modulus of the chosen steel was 242 GPa at room temperature and 222 MPa at the elevated temperature of 400 F, a nine percent decrease in elastic modulus as a consequence of increase in test temperature. Yield strength of the stainless steel at room temperature was 648 MPa and at the elevated temperature 530 Mpa; a noticeable twenty percent decrease in strength with increase in test temperature. The ultimate tensile strength (σUTS) at room temperature (27^0C) was 808 MPa and 718 MPa at the elevated temperature (205^0C), an observable decrease in strength by 11 percent due to increase in test temperature. The ductility, quantified by elongation-to-failure was 48.0% at room temperature (27^0C) and 40.0% at the elevated temperature (205^0C).
4. Tensile fracture at both temperatures was predominantly cup and cone morphology. High magnification observation of the fracture surface revealed a healthy combination of dimples of varying size, isolated microscopic voids, and macroscopic cracks. These features are indicative of both brittle and ductile failure mechanisms acting at the fine microscopic level. At both temperatures, the overload fracture surface revealed a population of voids of varying size and dimples, indicative of the occurrence of "locally" dominant ductile failure mechanisms.

FUTURE SCOPE

Different materials can used to analyze the fracture behavior and compare them. Specimens can be subjected to cyclic fatigue loading and fracture behavior can be analyzed.

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RESEARCH PAPER

Investigation of Arching Effect in Geosynthetic-Reinforced Piled Embankments

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Abstract
Column-supported embankments provide a practical and efficient solution for construction on soft soil due to the low cost and short construction times. In recent years, geosynthetics have been used in combination with column systems to support embankments. The load transfer mechanism in these systems is a combination of soil arching and membrane effect of the geosynthetics. In this paper, numerical method was used to improve the understanding of the long-term performance of geosynthetic-reinforced embankments supported on end-bearing piles. The distribution of skin friction, axial force distribution, settlements on the embankment and foundation soil surface, and vertical stresses on the pile head and foundation surface were studied. Finally, the results from the numerical studies were compared with the results from different analytical methods. Based on the numerical results obtained, modified arching coefficient is presented for end-bearing piles.

Keywords Piled embankments · Geosynthetic · Arching · Membrane action · Interaction · Consolidation

1 Introduction

In recent years, due to the advancement in geotechnical techniques and with the help of the latest technology, various ground improvement techniques are used to improve the in situ soil characteristics to suit the foundation of our choice. These techniques help in improving the shear strength and decreasing the compressibility, lateral displacement of soil. For large embankments over deep soft clay deposits, removal of existing soft soil is not practical and the use of low-density soils cannot reduce the loads transferred to the soft ground. When the gain in shear strength and stiffness due to consolidation is unpredictable and availability of land is insufficient to change the embankment geometry, one of the most dependable and convenient solutions among various techniques is the use of column supports to carry the embankment load. Column supports can be hard columns such as piles or semi-hard columns such as deep cement mixed columns and stone columns (Han and Gabr 2002). The technique consists of a grid of plain concrete piles driven through the soft layer and embedded in a competent substratum beneath, with an embankment above the piles. The conventional pile-supported system requires large pile caps and very closely spaced piles. In the recent years, geosynthetics have been used in combination with piles/column systems to support embankments over soft foundation soils. The application of geosynthetics in the embankment fill just above the piles enhances the load transfer from the soil to columns and reduces the total and differential settlements (Han and Gabr 2002; Liu et al. 2007; Jenck et al. 2009; Van Eekelen et al. 2011; Anjana and Rajagopal 2013, 2015). A single layer of reinforcement is assumed to act as a tensioned membrane (catenary) under the vertical load enabling the deflected basal reinforcement to be analyzed as a parabola (Collin et al. 2005). The load transfer mechanism in these systems is a combination of soil arching and the membrane effect of the geosynthetic. The tensile strength of geosynthetic depends on the portion of the embankment load that is transferred directly to piles due to soil arching. To construct effective and efficient piled embankments, design

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guidelines are required. Several guidelines for geosynthetic-reinforced piled embankment exist (BS8006-1 2010; EBGEO 2011; CUR 226 2010). As these design methods were developed based on different soil arching theories (Terzaghi 1943; Guido et al. 1987; Hewlett and Randolph 1988), the results obtained are not consistent (Smith and Filz 2007).

In this paper, stress–pore pressure coupled analyses were carried out to investigate the time-dependent long-term behavior of GRPS embankments using axisymmetric unit cell models. For practical reasons, unit cell approach is usually adopted to analyze the performance of geosynthetic-reinforced pile-supported (GRPS) embankments. Two-dimensional axisymmetric analysis is carried out since full three-dimensional analyses require high computer memory and analyses time. Even though the two-dimensional finite element models cannot completely represent the realistic conditions, it can give a sufficiently accurate result (Yoo and Kim 2009; Anjana and Rajagopal 2015).

Liu et al. (2007) described the case history of a GRPS highway embankment in Shanghai, China, and the measured field data were compared with the results from full 3D numerical analyses. The present work is based on this case study, and the time-dependent behavior of GRPS embankment systems under various conditions was investigated under different parameters such as the modulus of the column, tensile stiffness of the geosynthetic and pile center-to-center spacing.

2 Numerical Analyses

The finite element analyses were performed using ABAQUS (SIMULIA 2009) due to its robustness in numerical solution strategy for soil nonlinearity and stress–pore pressure coupled problems. Coupled analysis is based on the generalized consolidation theory of Biot (1941), which extended the Terzaghi's (1923) one-dimensional consolidation theory to three-dimensional conditions. This results in both displacement and pore fluid pressure degrees of freedom at the corner nodes of each element.

2.1 Site Conditions

The numerical models were developed by considering the site conditions reported by Liu et al. (2007). The site is located in northern suburb of Shanghai, China. Figure 1 represents the cross section of the embankment. The soil profile consists of a 1.5-m-thick coarse-grained fill of unit weight 20 kN/m^3 overlying a 2.3-m-thick deposit of silty clay having a unit weight of 20 kN/m^3; this deposit overlies a 10.2-m-thick soft silty clay of unit weight 18 kN/m^3. Underneath the soft silty clay, there is a 2-m-thick medium silty clay which is followed by 9-m-thick sandy silt. The ground water table is at a depth of 1.5 m. The height of the embankment is 5.6 m, and it spans 120 m in the direction perpendicular to its cross section. The crest width of the embankment is 35.2 m, and the side slopes are 1:1.5 (V/H). The embankment is supported by cast in situ concrete piles having external diameter (a) of 1 m and an embedded length of 16 m. Piles are arranged in a square pattern with a pile center-to-center spacing (s) of 3 m. The geosynthetic layer is sandwiched between two gravel layers, each of 0.25 m thickness. The embankment is constructed on the top of the gravel bed over a period of 55 days in nine lifts.

2.2 Methodology

In the first step of the analyses, geostatic command was invoked to establish the initial in situ stresses in the foundation soil. All the pile elements and embankment elements were removed at this stage. Once the geostatic equilibrium (entire model, $U_1 = U_2 = 0$) was established, pile elements were added and interaction was defined along the length of pile and at the top and bottom of pile, where it is in contact with soil. Layers of elements representing the reinforcement–gravel layer (0.5 m) were then added in a single step. Once the reinforcement layer was placed, interaction was activated along the reinforcement–gravel interface. Embankment fill (5.1 m) above the reinforced bearing layer was added in the next eight steps. Consolidation analysis was carried out in each of the steps resulting in settlements as soon as the reinforced bearing layer was placed. The total height of the embankment (5.6 m) was reached over a period of 55 days. After full placement of the embankment layers, consolidation analysis was carried out until the excess pore water pressure fell below a specified near zero value in the soil layer near and at the pile base level.

2.3 Material Models and Parameters

In the present study, four different materials were involved: foundation soil, embankment fill, pile and geosynthetic. The pile was modeled as an isotropic linear elastic material with a Young's modulus of 20 GPa and a Poisson's ratio of 0.2. The geogrid was modeled as an isotropic linear elastic material with a tensile stiffness of 1180 kN/m and a Poisson's ratio of 0.3. The embankment fill, gravel and the surface coarse-grained fill were modeled using a linear elastic–perfectly plastic model with Mohr–Coulomb failure criterion (Table 1). The four foundation soils were modeled as modified cam-clay materials, and the properties are given in Table 2.

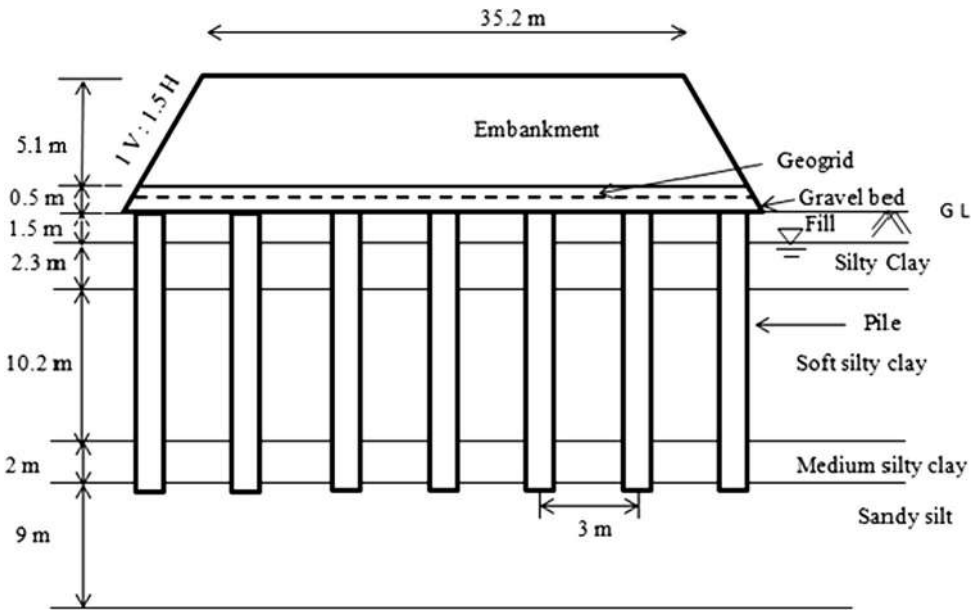

Fig. 1 Cross section of the embankment considered in the study based on Liu et al. (2007)

Table 1 Mohr Coulomb material model properties

Material	Cohesion, c' (kPa)	Angle of internal friction, Φ' (°)	Dilatancy angle, Ψ (°)	Young's modulus, (MPa)	Poisson's ratio, μ
Embankment	10	30	0	20	0.3
Gravel	10	40	0	20	0.3
Coarse-grained fill	15	28	0	7	0.3

Table 2 Modified Cam-clay material model properties

Material	μ	λ	κ	M	e_1	$k_w \times 10^{-4}$ (m/day)
Silty clay	0.35	0.06	0.012	1.20	0.87	8.64
Soft silty clay	0.40	0.15	0.030	0.95	1.79	4.32
Medium silty clay	0.35	0.05	0.010	1.10	0.88	4.32
Sandy silt	0.35	0.03	0.005	0.28	0.97	43.2

λ slope of the virgin consolidation line, κ slope of the swelling line, M slope of the critical state line, e_1 void ratio at unit pressure, k_w coefficient of permeability

2.4 Boundary Conditions and Elements Used

A displacement/rotation boundary condition was applied at the bottom and side of the numerical model to constrain the movement of the selected degrees of freedom to zero or to prescribe the displacement or rotation for each selected degree of freedom. At the bottom of the finite element mesh, fixed boundary condition is applied which implies the displacement in all the directions is set to zero ($U_1 = U_2 = 0$). Since the analysis had been done to only half of the unit cell, the model was considered symmetrical about the y-axis (about a plane $X = a$ constant). Hence, the left side of the model is applied with symmetrical boundary condition XSYMM in which displacement component $U_1 = 0$ and rotation components $UR_1 = UR_2 = 0$. A roller boundary condition is applied at the right side of the model in which the displacement along the X direction is restrained ($U_1 = 0$). Regarding the hydraulic boundary conditions, the water table was assumed to be at a depth of 1.5 m below the ground level and the initial pore pressures prior to the embankment construction were taken as hydrostatic. The bottom of the finite element mesh was defined as impermeable, and lateral flow was not permitted across the boundaries.

The elements used in this analysis were CAX8R (8-noded biquadratic axisymmetric quadrilateral with reduced

integration) for pile and embankment fill, CAX8RP (8-noded axisymmetric quadrilateral, biquadratic displacement, bilinear pore pressure, reduced integration) for foundation soil and MAX2 (3-node quadratic axisymmetric membrane) for geosynthetic.

2.5 Interaction

Contact in ABAQUS requires defining pairs of interacting surfaces called contact pairs—master and slave surfaces. The stiffer material is considered as the master surface (e.g., pile when pile–soil interaction is considered), and the flexible material in the pair is termed as the slave surface (e.g., geogrid when geogrid–gravel interaction is considered). Slave nodes should not penetrate master surface segments, whereas the nodes on the master surface can penetrate slave surface segments (Fig. 2). In the present study, pile–soil interaction and geogrid cushion layer interactions are considered. Once the contact pairs have been defined, appropriate contact property is chosen to define the interactions in the normal and tangential directions. (1) *Pile–soil interaction:* In the normal direction, the interface contact was assumed to be hard contact and no separation was allowed (Leng and Gabr 2005). In the tangential direction, Coulomb friction model was used to simulate the interaction, wherein the frictional behavior is specified by an interface friction coefficient (μ) and a limiting displacement. For the present study, limiting displacement of 5 mm was considered based on the findings by Lee et al. (2002). The interface friction coefficient (μ) was calculated from tanδ where δ (friction angle between the soil and pile) = $\frac{3}{4}\varphi$(internal friction angle of soil). (2) *Reinforcement–fill interaction:* Membrane action of the reinforcement depends on the interaction between the reinforcement and the embankment fill material. In the normal direction, the interface contact was assumed to be hard contact and no separation was allowed. In the tangential direction, Mohr–Coulomb failure criterion was used to determine the critical shear stress at interface. Cohesion was considered as zero, and the friction angle at the interface was taken equal to the friction angle of the gravel, for the calculation of critical shear stress (Liu et al. 2007).

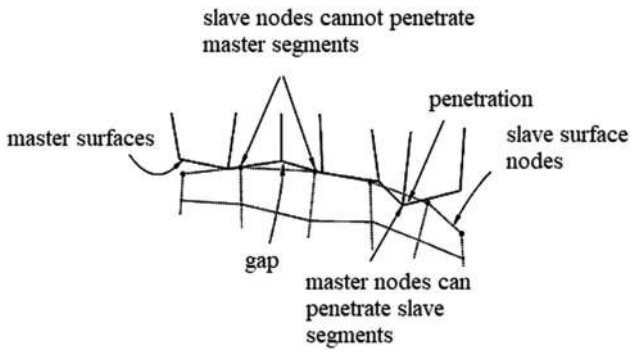

Fig. 2 Contact pairs—master and slave surface (SIMULIA 2009-ABAQUS)

2.6 Validation of the Interaction Model Adopted in Present Study

The axisymmetric model adopted was able to predict the settlements and stresses reasonably close to the field measurements reported by Liu et al. (2007) for 125 days after the completion of the embankment (Anjana and Rajagopal 2015). Load transfer mechanism in geosynthetic-reinforced piled embankments is a function of complex soil–structure interaction between the reinforcement, foundation soil and the pile. To account for this behavior, interaction between pile and foundation soil, and reinforcement and coarse-grained fill is considered in this study. The interaction model adopted was validated with the skin friction study carried out by Yao et al. (2012). They presented the study of negative skin friction developed along a super-long pile caused by the soil settlements under large-scale surcharge loading. Numerical results (Fig. 3) based on the interaction model adopted in the presented study showed good agreement with the analytical and measured data given in Yao et al. (2012).

3 Results and Discussion

In geosynthetic-reinforced piled embankments, the load from the embankment is transferred by soil arching and geosynthetic tension. The amount of load transferred to the pile, foundation soil and geosynthetic is studied by

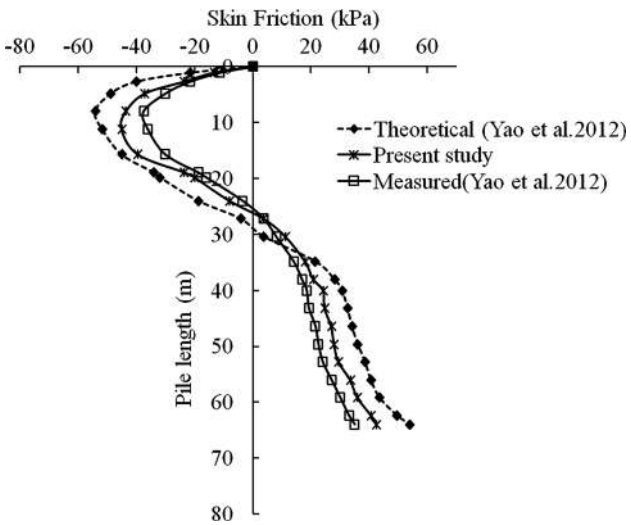

Fig. 3 Validation of the negative skin friction based on Yao et al. (2012)

changing various parameters. Studies were carried out for both reinforced and unreinforced piled embankments with commonly adopted pile spacings of 2.5 m, 3.0 m and 3.5 m. All the parameters were studied with respect to the two critical time periods: (a) end of construction and (b) end of consolidation. Settlement studies showed that consolidation settlements started immediately after the placement of the first layer of embankment soil. During the sequential construction of the embankment in layers, excess pore water pressures were generated within the foundation soil. Consolidation analysis was carried out till the excess pore pressure reduced to near zero in the soil at the pile base level. Figure 4 shows the change in excess pore pressure with respect to time from the numerical analyses. Based on the plot, in all the analyses, 650 days was taken as the time for end of consolidation.

3.1 Load Transferred to the Pile

Majority of the embankment load in GRPS embankments is transferred to the piles due to the soil arching effect. The stiffness of the foundation soil is much lower than the stiffness of the piles. Due to this stiffness difference, the vertical stress from the embankment fill is concentrated onto the piles. Numerically, this phenomenon is investigated by calculating the term stress concentration ratio.

3.1.1 Stress Concentration Ratio (SCR)

The degree of load transfer due to the stiffness difference between pile and soil is quantified by an index called stress concentration ratio (Han and Gabr 2002). It is considered as the ratio of average vertical stress on pile head to the average vertical stress acting on foundation soil. When the stress concentration ratio is high, it indicates that more embankment load is transferred to the piles. The variation of stress concentration ratio with height of embankment (Fig. 5), pile modulus (Fig. 6) and stiffness of geosynthetic (Fig. 7) is studied for the commonly adopted pile spacings in the field (s = 2.5 m, 3.0 m and 3.5 m). The reinforcement enhances the stiffness of the geosynthetic–soil platform, and less soil arching is developed (Han and Gabr 2002). The unarched vertical stress between the piles is taken by the reinforcement portion between the stiff piles. A single layer of reinforcement acts like a tensioned membrane (catenary), and the load applied normal to the surface of the reinforcement creates tension in the membrane. A portion of the load is transferred to the piles through the vertical component of the tensile forces in the membrane. This membrane effect makes the stress concentration ratio for the reinforced case higher than that for the unreinforced case.

As the embankment height increases, SCR increases and the variation in SCR value becomes less after a particular height of embankment for reinforced (R) and unreinforced (U) case. This further proves that at a particular height from the embankment base, the settlements above the pile and the subsoil surface will be approximately the same which are called the plane of equal settlement. As a result, the differential settlement is reduced with increase in

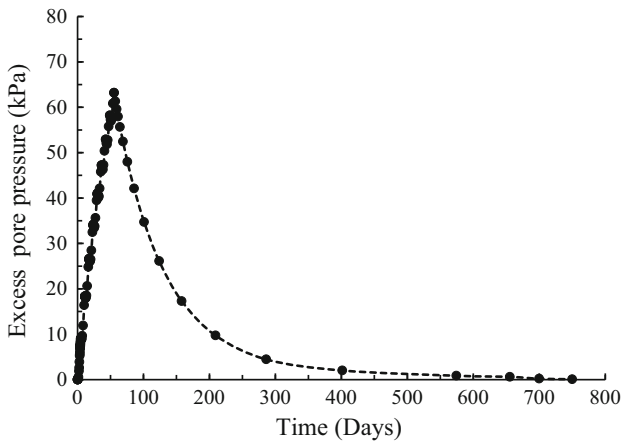

Fig. 4 Time history of excess pore pressure in the soil at the pile base level

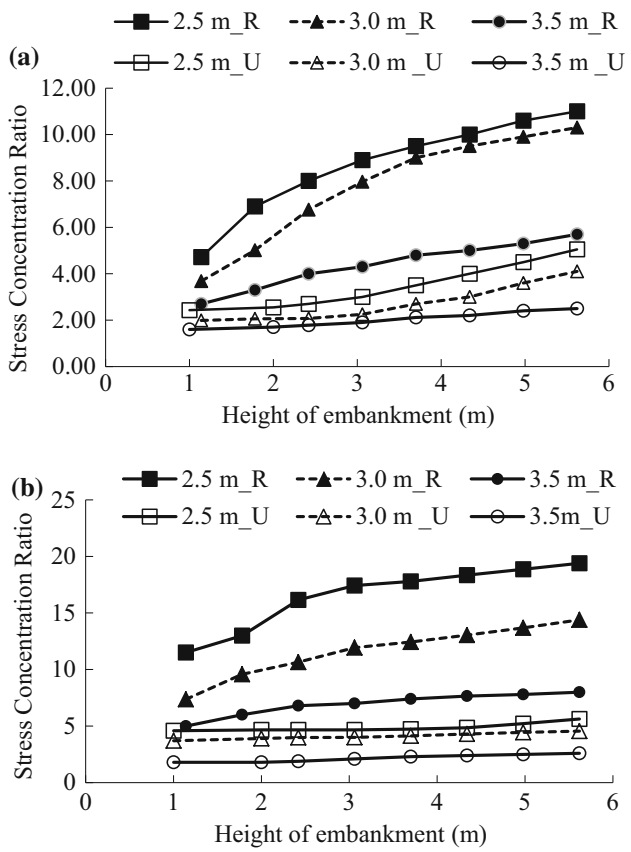

Fig. 5 Influence of embankment height on SCR **a** end of construction; **b** end of consolidation

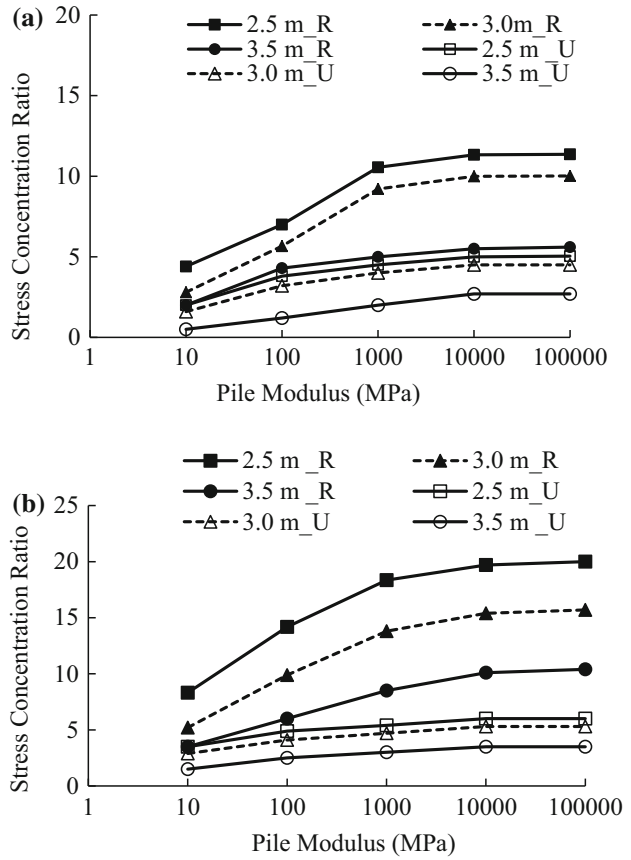

Fig. 6 Influence of pile modulus on SCR on SCR **a** end of construction; **b** end of consolidation

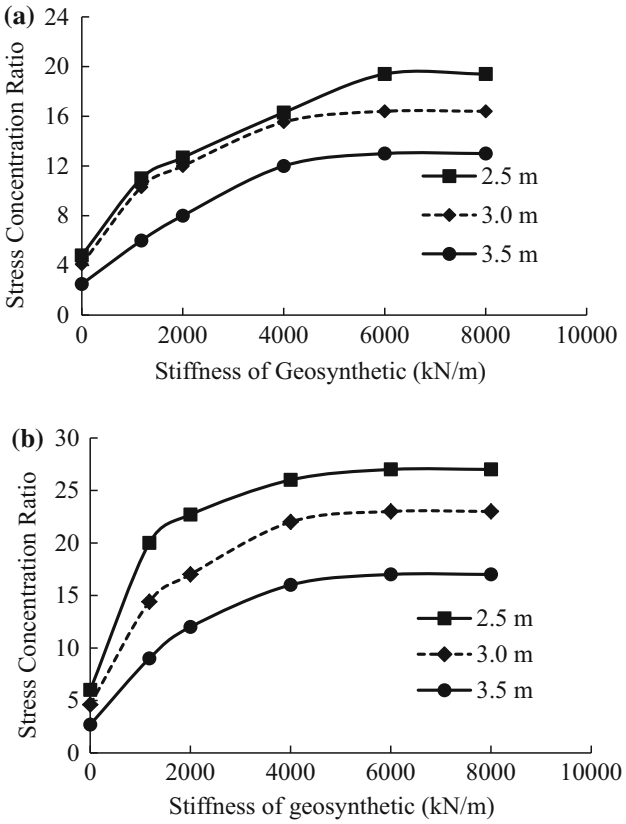

Fig. 7 Influence of geosynthetic stiffness on SCR **a** end of construction; **b** end of consolidation

embankment height beyond full arching height and less soil arching is developed. However, the load transferred to the pile is increased with reinforcement, due to the membrane action of the reinforcement. A large pile center-to-center spacing of 3.5 m in field is economical, but it is not able to aid in the development of arches which considerably reduces the embankment weight transferred to piles due to the arching effect (Fig. 5). SCR is found to increase with an increase in pile modulus (Fig. 6). A higher stiffness of pile increases the differential settlement between the stiffer pile and the soft foundation soil, promoting more load transfer to piles by the formation of arches. When the embankment is reinforced with geosynthetic, the presence of reinforcement will enhance the stress transfer from embankment fill to the piles. This is indicated in the graph showing the variation of stress concentration ratio with stiffness of geosynthetic (Fig. 7). The increase in stress concentration ratio with reinforcement stiffness indicates that the application of reinforcement at the embankment base together with proper pile center-to-center spacing enhances stress transfer from the fill to the piles and this can, in turn, reduce the embankment settlement considerably. For all the cases (Figs. 5–7), SCR increased at the end of consolidation. Figure 8 shows the development of arching for geosynthetic-reinforced piled embankment with time (spacing = 3.0 m and reinforcement stiffness = 1180 kN/m). Observation of arches showed that arching action is not an instantaneous phenomenon and the development of arches started during the construction phase and arches were fully developed after some amount of consolidation has taken place. The orientation of principal stresses showed the arch shape as inverted catenary (Fig. 8) as assumed by Hewlett and Randolph (1988).

3.1.2 Soil Arching Ratio or Stress Reduction Ratio

The term soil arching ratio was used by McNulty (1965) to define the degree of soil arching, and it was based on the test results by Terzaghi (1943). Due to the difference in stiffness between the pile and the soft foundation soil, a relative movement occurs between pile and the foundation soil. The downward movement of embankment fill above the soft foundation soil is restrained by the shear resistance developed along the interface in the fill, which reduces the pressure acting on the foundation soil and thereby increasing the load transferred to the piles. This effect is

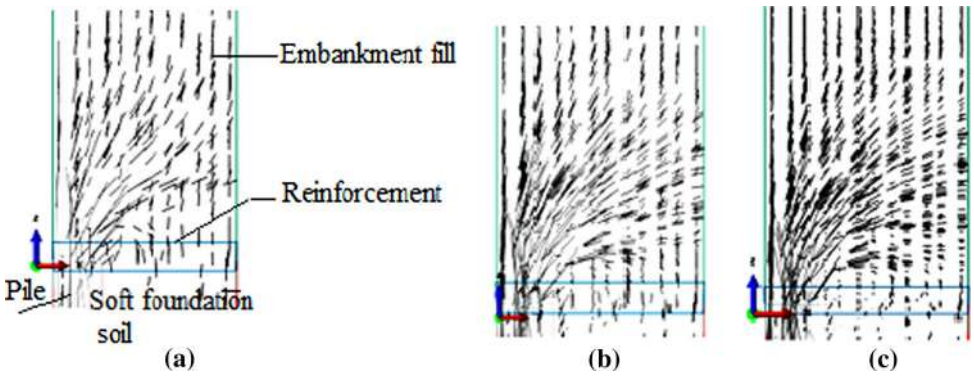

Fig. 8 Development of soil arching **a** end of embankment construction **b** 20 days after embankment construction **c** 100 days after embankment construction

known as soil arching effect, and the degree of this effect is defined as soil arching ratio (ρ) given by:

$$\rho = \frac{p_b}{\gamma H + q_0}, \quad (1)$$

where p_b is the applied pressure on the top of the reinforcement, γ is the unit weight of embankment fill, and q_0 is the uniform surcharge on the embankment. If the soil arching ratio is zero, it indicates complete soil arching, and if the ratio is equal to one, it represents no soil arching.

Variation of soil arching ratio with embankment height at different pile center-to-center spacing (2.5 m, 3.0 m and 3.5 m) is shown in Fig. 9. From the results, it is observed that the shear resistance in the fill was not large enough to develop the arching for low embankment height and hence increases the pressure applied on to the reinforcement and foundation soil. With an increase in the embankment height, more shear resistance accumulates which enhances the soil arching mechanism. When reinforcement is provided at embankment base, it stiffens the soft soil layer between the piles reducing the different settlements. Reduced differential settlement hinders the development of arches. As a result, soil arching ratio is greater for the reinforced case than the unreinforced case. The pile stiffness also has great influence on the soil arching ratio. The variation of soil arching ratio with pile modulus is represented in Fig. 10. From Fig. 10, it is observed that the soil arching ratio decreased with an increase in pile modulus for both the reinforced and unreinforced cases up to 10,000 MPa. Increase in pile/column modulus beyond 10,000 MPa had negligible influence on the arching ratio.

The influence of reinforcement stiffness on soil arching ratio is represented in Fig. 11. The stiffness of reinforcement plays a very important role in soil arching. It can be observed that with increase in the reinforcement stiffness, differential settlement in fill reduces and the amount of load transferred to piles due to soil arching reduces. The net effect increases in soil arching ratio. When pile spacing is increased to 3.5 m, effective transfer of shear stress at the embankment fill above the pile is disturbed and arches

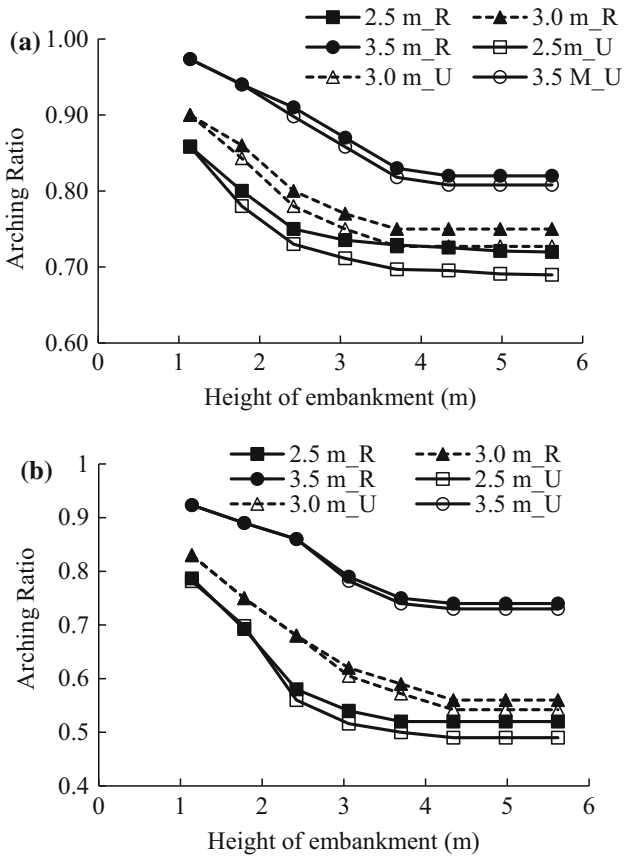

Fig. 9 Influence of height of embankment on arching ratio **a** end of construction; **b** end of consolidation

are not formed. This is evident from the high values of arching ratio for unreinforced as well as reinforced case with different stiffness values. Similar trend is also observed at the end of foundation soil consolidation (Fig. 11a).

3.2 Vertical Stress Acting on the Pile Head and Foundation Soil Surface

Tables 3 and 4 show the variation of vertical stresses acting on the pile head and on the foundation soil surface at the

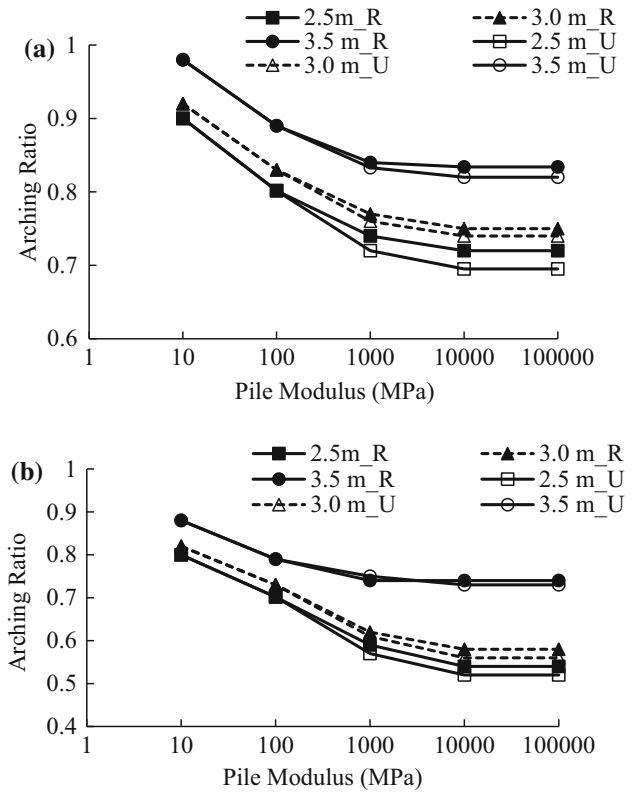

Fig. 10 Influence of pile modulus on arching ratio **a** end of construction; **b** end of consolidation

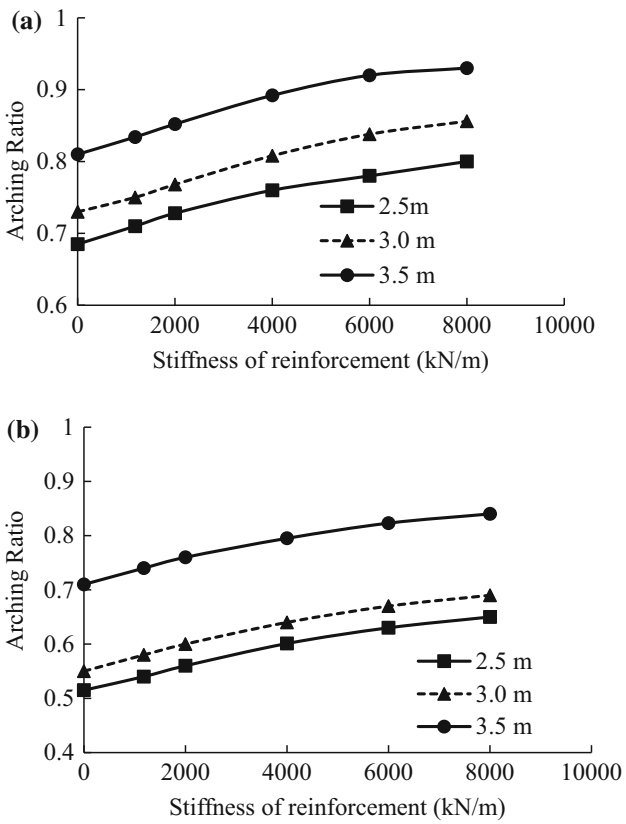

Fig. 11 Influence of reinforcement stiffness on arching ratio **a** end of construction; **b** end of consolidation

end of construction of the embankment and at the end of soil consolidation. The vertical stress acting on the pile head and the foundation soil surface increases rapidly during the period of construction, whereas in the consolidation phase, the vertical stresses on the soft soil decreased, while the vertical stress on the pile head increased. This behavior can be explained by the observation in Sect. 3.1.1 that the development of full arching takes place only during the consolidation phase after the construction of embankment. As the pile spacing increases from 2.5 to 3.5 m, the vertical stresses on foundation soil surface are found to considerably increase. This shows that for the load transfer mechanism to fully develop in geosynthetic-reinforced piled embankments, pile center-to-center spacing plays a major role.

3.2.1 Arching Coefficient for End-Bearing Piles from Numerical Analyses

The British Standard BS8006-1 (2010) is the most widely used method for the design of geosynthetic-reinforced piled embankments, and it is very conservative (Van Eekelen et al. 2011). Based on Marston and Anderson (1913) formula for positive projecting conduits, Jones et al. (1990) developed an empirical relationship (Eq. 2) for the ratio of average vertical stress acting on the pile head to the average vertical stress acting across at the base of the embankment.

$$\frac{p'_c}{\sigma'_v} = \left(\frac{a_c a}{H}\right)^2, \tag{2}$$

where p'_c = arched vertical stress per unit length at the top of the conduit/pile, σ'_v = average vertical stress per unit length at the top of the conduit/pile, a_c = arching coefficient (Marston and Anderson 1913), a = pile diameter, and H = embankment height.

BS8006-1 (2010) gives empirical equations for arching coefficient a_c as follows:

$$\begin{aligned} \text{End bearing piles, } a_c &= 1.95\frac{H}{a} - 0.18 \\ \text{Friction piles, } a_c &= 1.5\frac{H}{a} - 0.07. \end{aligned} \tag{3}$$

In the present study, concrete pile is resting on a hard sandy silt layer; hence the pile is assumed to be an end-bearing pile. From the numerical analyses, the value for vertical stress acting on the pile head is found for different pile spacings and from Eq. 2 arching coefficient values are calculated. By using curve fitting method, for the range of pile spacing commonly adopted in field ($2 \leq s \geq 3.5$), the

Table 3 Vertical stress acting on pile head for different pile spacing's

Height of embankment (m)	S = 2.5 m		S = 3 m		S = 3.5 m	
	End of construction	End of consolidation	End of construction	End of consolidation	End of construction	End of consolidation
1.1	140.0	148.0	140.0	146.4	100.8	136.7
2.0	211.6	220.9	206.5	215.5	163.6	186.7
2.4	282.0	339.1	267.6	314.9	214.0	269.3
3.1	348.5	395.3	329.1	385.7	249.8	337.0
3.7	413.4	468.9	390.00	461.2	299.5	407.0
4.3	478.4	540.3	452.6	533.1	375.5	509.5
5.0	542.5	608.7	507.2	603.5	465.8	561.6
5.6	607.1	676.4	580.3	674.8	553.8	642.0

Table 4 Vertical stress acting on foundation soil surface for different pile spacings

Height of embankment (m)	S = 2.5 m		S = 3 m		S = 3.5 m	
	End of construction	End of consolidation	End of construction	End of consolidation	End of construction	End of consolidation
1.1	30.7	12.9	36.8	19.9	42	27.3
2.0	31.6	17.0	37.5	22.5	49.6	31.1
2.4	33.4	21.0	39.5	29.6	53.5	39.6
3.1	36.6	22.7	41.3	32.3	58.1	48.1
3.7	40.3	26.4	43.3	37.1	62.4	55.0
4.3	44.0	29.5	47.6	40.9	75.1	66.6
5.0	46.8	32.3	51.2	44.1	87.9	72.0
5.6	50.4	34.9	56.3	46.9	100.7	80.3

following equation is proposed for determining the arching coefficient of end-bearing piles.

$$a_c = m * H^n, \quad (4)$$

where $m = -0.2127*s + 3.2175$ and $n = 0.02015*s + 0.9284$

Pile center-to-center spacing (s) is related to pile diameter (a) with the following equation:

$$a = 1.746e^{-0.222*S}. \quad (5)$$

From Eqs. 4 and 5, arching coefficient depends on embankment height (H), pile center-to-center spacing (s) and diameter/width of piles (a). Numerical studies have shown that pile spacing (s) also plays a major role in load transfer and this parameter is neglected in the equation for arching coefficient in BS8006-1 (2010). Figure 12 shows the variation of arching coefficient with embankment height for different pile spacings using the proposed equation, numerical analyses and BS8006-1 (2010).

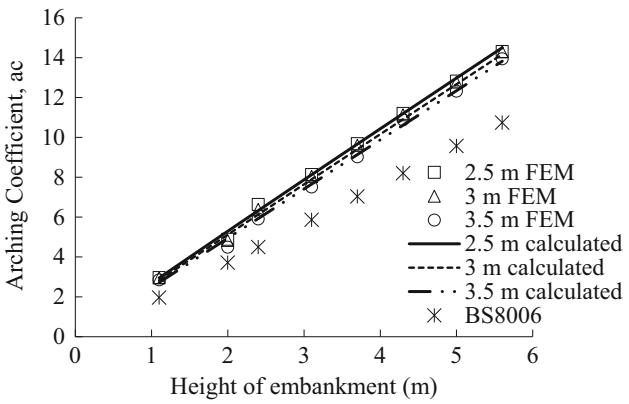

Fig. 12 Comparison of arching coefficient from proposed equation, analyses and BS8006-1 (2010)

Results from the proposed equation are found to be compatible with those obtained from the numerical analyses.

3.3 Load Transfer by Reinforcement

The load transfer mechanism in the GRPS system is the combined effect of soil arching, stress concentration and reinforcement tension. The unarched vertical stress between the piles is assumed to be taken by the horizontal reinforcement. This load applied normal to the surface of the reinforcement creates tension in the polymeric material leading to the membrane effect (Zhan and Yin 2001). The tensile force developed in the reinforcement is transferred to the piles through the vertical component (Han and Gabr 2002).

Numerical analyses help to determine the amount of load transferred by membrane action of the reinforcement to the pile head. The maximum tension developed in the reinforcement from the numerical study for different pile spacings is given in Table 5. In the case of 2.5 m spacing, due to the development of arches, a major portion of the load is taken by the piles. This reduces the load on reinforcement, which in turn reduces the tension developed in the reinforcement. As the pile spacing is increased to 3.0 m, the effect of arching reduces, transferring more load to reinforcement. With further increase in pile spacing to 3.5 m, load transferred to pile is considerably reduced. Also, reinforcement does not take up much load as there is no tensioning in the material which is clear from the tensile force developed in the reinforcement at different time periods (Table 5). Numerical analyses results indicate that for geosynthetic-reinforced piled embankment systems, a pile center-to-center spacing of up to 3d is effective in the development of an efficient load transfer mechanism.

3.4 Negative Skin Friction and Axial Force Study

Studies about stress concentration ratio and soil arching ratio for reinforced and unreinforced piled embankments at different pile spacings showed that the major portion of embankment weight is transferred to piles through soil arching. Reinforcement tension also helps in transferring a portion of the load to piles. Thus, load-carrying capacity of piles plays a major role in the success of GRPS embankments. According to Cao and Zhao (2012), negative skin friction induced along the pile length influences the settlement of pile and this affects the performance of piled embankments.

From the numerical analyses, negative skin friction values are found with the help of total shear force developed along the axial length on the surface of pile elements. In the study conducted, the entire pile was divided into many sections and axial force along each section was found out. The total shear force corresponding to the local coordinate system at different sections of the pile was obtained, and from these values, the skin friction at each section was calculated by taking the ratio of total shear force to the perimeter of the pile shaft. The skin friction can therefore be calculated as:

$$f_s = \tau/(\pi a l), \tag{6}$$

where f_s is the skin friction at section selected, τ is the total shear force at the section, a is the pile diameter, and l is the depth from pile top to the section.

The total shear force values obtained from the numerical analyses were used to calculate the skin friction values along the pile length. Skin friction values were calculated for different time periods from the end of construction. Figure 13a, b shows the skin friction distribution along the pile length for different pile spacings (s = 2.5 m and 3 m based on the observation in Sect. 3.3).

The negative skin friction value decreases as depth increases, and at a point, it changes its sign (positive shaft resistance). The negative skin friction thus obtained can reduce the axial load acting on the piles. The depth at which skin friction value becomes equal to zero which is termed as neutral depth was also determined and is given in Table 6. From Table 6, it is observed that as consolidation

Table 5 Maximum tensile force developed in the reinforcement for different pile spacings

Height of embankment (m)	S = 2.5 m		S = 3 m		S = 3.5 m	
	End of construction	End of consolidation	End of construction	End of consolidation	End of construction	End of consolidation
1.1	1.3	3.1	2.0	10.8	0.6	0.7
1.8	1.9	3.9	2.9	14.0	1.4	1.4
2.4	2.8	5.5	4.0	16.6	1.8	1.9
3.1	3.8	8.5	5.3	18.9	2.0	2.1
3.7	4.9	11.7	6.6	20.8	2.2	2.2
4.3	6.1	14.1	8.2	22.8	2.3	2.4
5.0	7.4	16.4	9.7	24.8	2.5	2.6
5.6	8.7	18.9	11.3	27.0	3.0	3.1

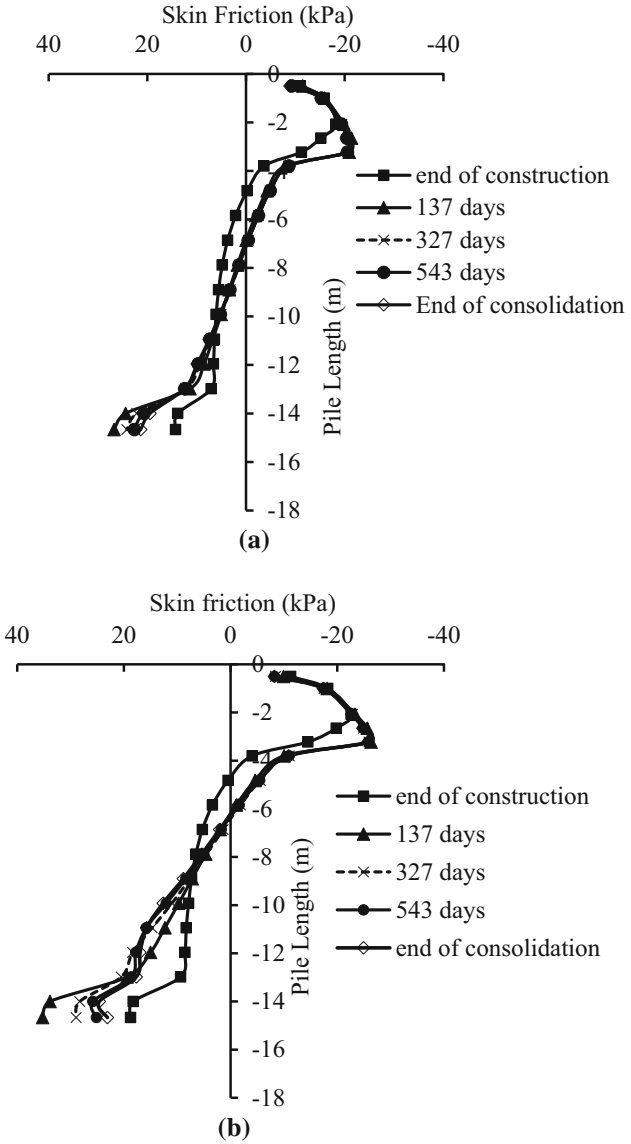

Fig. 13 Skin friction variation along pile length for **a** s = 2.5 m; **b** s = 3 m

Table 6 Neutral depth values for different pile spacings

Time (days)	2.5 m	3 m
55 (end of construction)	5.6	4.7
137	6.8	6.2
327	7.1	6.3
543	7.1	6.4
650 (end of consolidation)	7.1	6.4

proceeds the neutral depth goes on increasing and attains a final value once consolidation is complete.

Along with the skin friction study, axial force distribution along the pile length is also studied. Axial force (P_a) is calculated by multiplying vertical stress in the pile element with the *c*/*s* area of pile at that elevation and is given by:

$$P_a = \text{stress} * \text{area} = \sigma_v \frac{\pi}{4} a^2, \quad (7)$$

where 'σ_v' is the vertical stress in the pile element averaged at an elevation and 'a' is the pile diameter/width at that elevation.

The variation of axial force along the pile length for pile spacings of 2.5 m and 3 m is plotted in Fig. 14a, b.

Along the pile length, the axial force initially increases and after reaching the maximum value it tends to decrease. The initial increase in axial force is due to the negative drag forces developed in the upper sections of the pile where the settlement of the soft foundation soil is more than the settlement of the pile. Axial force is maximum at the neutral plane where the change of negative skin friction to positive skin resistance takes place. Beyond the depth of neutral plane, the axial force in the pile is gradually

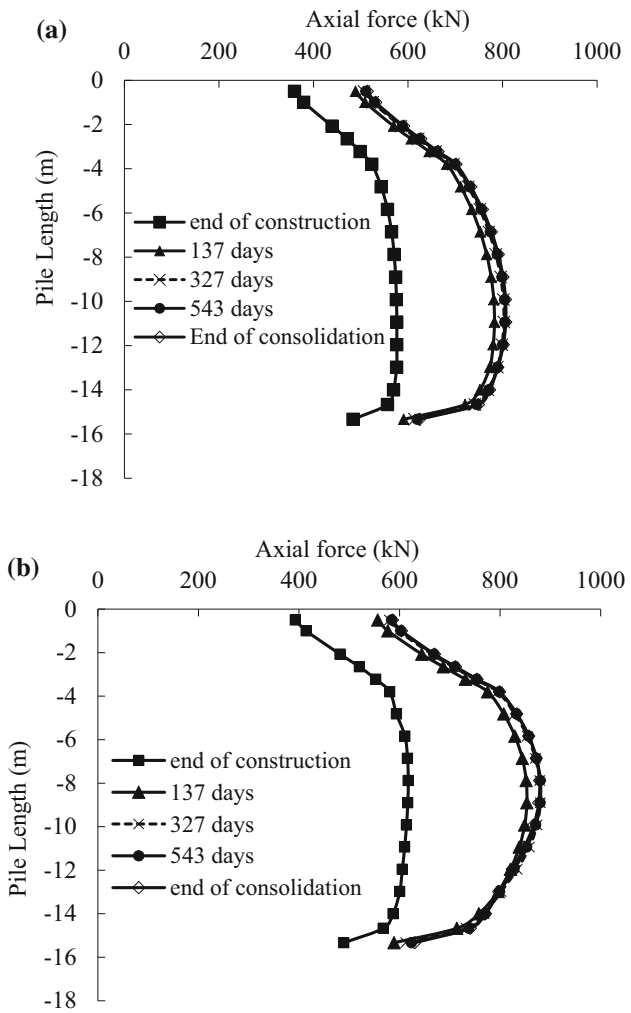

Fig. 14 Axial load variation with elevation for **a** s = 2.5 m; **b** s = 3 m

reduced because of the positive skin friction acting along the surface of the pile. In GRPS embankments, due to the formation of soil arches in the embankment fill, more load is transferred to the piles reducing the negative skin friction. Depth of neutral plane from the pile head decreases when the pile center-to-center spacing is increased to 3 m as more load transfer to pile takes place and positive skin friction starts to develop along the pile length.

3.5 Comparison of Various Design Techniques Using Stress Reduction Ratio (S_{3D})

Various design methods are available for the design of GRPS embankments. The value of stress reduction ratio obtained from the various empirical methods, BS8006-1 (2010) and the present numerical study are compared. Stress reduction ratio is a parameter introduced by Low et al. (1994), which is defined as the ratio of the average vertical stress carried by reinforcement to the average vertical stress due to embankment fill. The stress reduction ratio is calculated using different design methods (Terzaghi 1943; Guido et al.1987; Hewlett and Randolph 1988; Low et al. 1994; Kempfert et al. 2004; Abusharar et al. 2009; BS8006-1 2010) for different pile center-to-center spacings and embankment heights. Table 7 gives the equations used in different methods for calculating S_{3D}. Analytical results are compared with the values obtained from numerical analyses.

3.5.1 Comparison of S_{3D} from Different Design Methods and FE Analyses Based on Pile Spacing

The stress reduction ratio (SRR) obtained from various empirical methods and the present numerical analyses is shown in Fig. 15. Numerical analyses results predicted higher values for stress reduction ratio compared to different empirical methods. Numerical simulations have shown that arching formation is not an instantaneous phenomenon (Sect. 3.1.1). Arching process starts during the construction phase, as consolidation settlement starts immediately after the placement of the first layer of fill. Full development of arches occurs sometime after the completion of embankment construction (Fig. 8). When pile center-to-center spacing is very large (3.5 m and above), arches are not formed properly and this reduced the load transferred by soil arching which in turn increased the SRR. All the empirical methods including BS8006-1 (2010) gives the SRR at the end of embankment construction, and these methods fail to account for the effect of consolidation on arching. This is best accounted for in numerical simulations which make use of Biot's (1941) consolidation theory.

3.5.2 Comparison of S_{3D} from Different Design Methods and FE Analyses Based on Embankment Height

Figure 16 shows the variation of stress reduction ratio with embankment height. Analytical methods, BS8006-1 (2010) and numerical simulations show that S_{3D} decreases with an increase in embankment height. As discussed earlier, with an increase in embankment height, the shear resistance in the fill is large enough to develop arching and transfer more embankment load to the pile top. According to BS8006-1 (2010), when the embankment height is more than the critical height of 1.4(s–a), the height of embankment above critical height plays no role in the forces developed in the reinforcement layer as full weight is transferred to the piles. This trend is not shown by numerical simulations. Figure 16 shows that at a height of 4.6 m and 5.6 m, S_{3D} values from numerical analyses are nearly the same. This shows the existence of plane of equal settlement, which is formed due to same settlements in the embankment fill above the stiff pile and the soft foundation soil surface. The differences in numerical simulations and empirical methods are attributed to reasons already stated in Sect. 3.5.1.

4 Conclusions

In this paper, finite element-based numerical method was used to improve the understanding of the long-term performance of GRPS embankments on end-bearing piles. Parametric studies based on coupled analyses using Biot's (1941) consolidation theory were carried out using axisymmetric models. Reduction in computational time with the use of Axisymmetric models is proven in literature, and also studies have shown that axisymmetric models are able to predict the behavior of GRPS embankments with reasonable accuracy. Detailed pile–soil and reinforcement–gravel interaction was considered in all the analyses. Load transferred by soil arching and membrane action of reinforcement, distribution of negative skin friction and axial force, vertical stresses on the pile head and foundation surface were studied. Based on the numerical simulations, the following conclusions were drawn:

- As the embankment height increased, stress concentration ratio (SCR) which is a measure of the degree of the load transferred to the stiff piles increased due to the development of enough shear stress in the fill which enhanced the soil arching mechanism. Once the height of embankment reached the plane of equal settlement, variation in SCR became less significant for both reinforced and unreinforced cases.
- Numerical simulations indicated that for geosynthetic-reinforced piled embankment systems, a pile center-to-

Table 7 Equations for calculating S_{3D} from different analytical methods

Authors	Stress reduction ratio (S_{3D})
Terzaghi (1943)	$S_{3d} = \frac{\left(1-e^{-\frac{4HaK\tan\varphi'}{s^2-a^2}}\right)\times\left(s^2-a^2\right)}{4HaK\tan\varphi'}$
Guido et al. (1987)	$S_{3d} = \frac{s-a}{3\sqrt{2}\times H}$
Hewlett and Randolph (1988)	At the crown
	$S_{3D} = \left(1-\left(\frac{a}{s}\right)\right)^{2\times(Kp-1)}\times\left(1-\frac{s\times 2(Kp-1)}{\sqrt{2}H(2Kp-3)}+\frac{(s-a)2(Kp-1)}{\sqrt{2}H(2Kp-3)}\right)$
	At the pile head
	$S_{3D} = \frac{1}{\frac{2Kp}{kp+1}\left[\left(1-\left(\frac{a}{s}\right)^{(1-Kp)}-\left(1-\left(\frac{a}{s}\right)\right)\left(1-\left(\frac{a}{s}Kp\right)\right)+\left(1-\left(\frac{a^2}{s^2}\right)\right)\right)\right]}$
Low et al. (1994)	$S_{3D} = \frac{\sigma_s-\left(\frac{tE_s}{D}\right)}{\gamma H}$
Kempfert et al. (2004)	$S_{3D} = \frac{1}{\gamma H}\left\{\lambda 1^x\left(\gamma+\left(\frac{q}{H}\right)\right)\left[H(\lambda 1+h_g^2\lambda_2)^{-x}+h_g\left(\lambda 1+\left(\frac{h_g^2\lambda 2}{4}\right)\right)^{-x}-\left(\lambda 1+h_g^2\lambda 2\right)^{-x}\right]\right\}$
	where
	h_g = arching height $= s/2$ for $h \geq$ s/2 and $h_g = h$ for $h < s/2$
	$\chi = \frac{a(K_{crit}-1)}{\lambda_2 s}, K_{crit} = \tan^2\left[45^\circ+\frac{\phi_k'}{2}\right], \lambda_1 = \frac{1}{8}(s-a)^2, \lambda_2 = \frac{s^2+2a(s-a^2)}{8}$
Abusharar et al. (2009)	$S_{3D} = \frac{\sigma_s-\left(\frac{tE_s}{D}\right)}{\gamma H}$
BS8006-1 (2010)	For partial arching, $S_{3D} = \frac{1}{(s^2-a^2)}\left[s^2-a^2\left(\frac{P_c}{\gamma H}\right)\right]$
	For full arching, $S_{3D} = \frac{1.4}{H(s+a)^1}\left[s^2-a^2\left(\frac{P_c}{\gamma H}\right)\right]$

Here, H is the embankment height, a is the pile diameter/width, s is the pile center-to-center spacing, φ' is the friction angle of embankment fill, K is the coefficient of earth pressure at rest, ϕ_k' is the characteristic value of friction angle of the embankment material, γ is the unit weight of embankment material, p_κ is the characteristic value of live load, σ_s is the vertical stress acting on the foundation soil, t is the maximum vertical displacement of the foundation soil between pile caps, E_s is the elastic modulus of the foundation soil, D is the depth of the foundation soil, and P_c is the arched vertical stress per unit length at the top of the pile

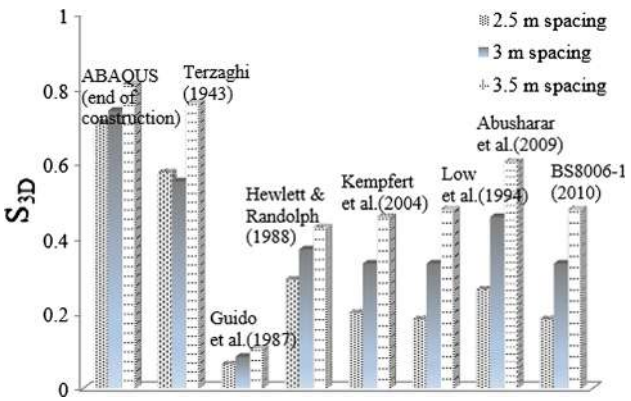

Fig. 15 Variation of S_{3D} with pile center-to-center spacing

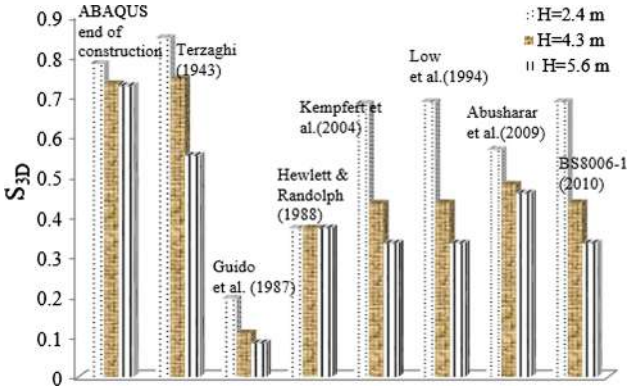

Fig. 16 Variation of S_{3D} with height of embankment

center spacing of up to 3d is effective in the development of an efficient load transfer mechanism. A large pile center-to-center spacing in field was economical, but large spacing of piles was not able to aid in the development of arches which reduced considerably the embankment weight transferred to piles due to the arching effect.

- Studies at the end of embankment construction as well as at the end of foundation soil consolidation indicated that the stress on pile head was more than that on the foundation soil for reinforced as well as for unreinforced embankment. This indicated that a larger portion of the embankment load was transferred to the piles by soil arching which forms the main component in the load transfer mechanism in GRPS.

- As most of the embankment load is taken by piles, time-dependent development and distribution of negative skin friction and axial force along the pile length are very important. Skin friction distribution depends on the correct simulation of interaction effect between pile and surrounding soil. Interaction studies showed that the negative skin friction value decreased as the depth from pile head increased and at neutral plane, skin friction values reduced to zero. After the neutral plane, positive shaft resistance developed as the pile settled more than the surrounding soil. Axial force was maximum at the neutral plane, and beyond the depth of neutral plane, the axial force in the pile gradually reduced because of the positive shaft resistance acting along the surface of the pile. It was observed that as consolidation proceeded, neutral depth reduced and attained a final value once consolidation completed.
- Arching is a time-dependent phenomenon which started during the construction stage and full arches developed during the foundation soil consolidation after the completion of embankment. Empirical methods failed to account for the effect of consolidation on arching.
- The orientation of principal stresses in the numerical results showed the arch shape as inverted catenary as assumed by Hewlett and Randolph (1988).
- Based on the numerical studies, an equation is proposed for calculating arching coefficient for end-bearing piles, which depends on height of embankment (H), pile diameter/width (a) and pile center-to-center spacing (s).

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Development of self-curing concrete using polyethylene glycol as internal curing agent

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Abstract

Self-curing or internal curing is a process in which moisture present in the concrete is preserved for more effective hydration of cement and reduced self-desiccation. In this paper, Self-curing concrete of M20, M40 and M60 grades are developed using optimized dosage of polyethylene glycol as internal curing agent. Compressive, split-tensile and flexural strength properties of self-curing concrete mixes are evaluated and exhaustive cost analysis is made on internally and externally cured concrete for economic feasibility. The optimum dosage of polyethylene glycol (PEG) (expressed in percentage by weight of cement) for M20, M40 and M60 grades self-curing concrete are 1%, 0.5% and 0.5% respectively. There is a significant increase of about 5-20% in the compressive, split-tensile and flexural strength properties of self-curing concrete mixes when compared to normal externally cured concrete mixes for all the grades considered for study. This improvement may be attributed to the continuation of the hydration process as a result of continuous availability of water. This resulting in, lower voids and pores, and greater bond force between the cement paste and aggregate. It was found that there is significant cost saving ranging from Rs. 2500 -3000 per cubic meter of concrete if internally cured. © IAEME Publication.

Author keywords

Cost analysis; Internal curing; Polyethylene glycol; Self-curing concrete; Self-desiccation

Cost analysis, Internal curing, Polyethylene glycol, Self-curing concrete, Self-desiccation

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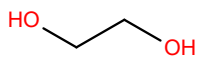

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Experimental investigation on Utilization of RCA in Low, Medium and High Strength Self Compacting Concrete

Experimental investigation on Utilization of RCA in Low, Medium and High Strength Self Compacting Concrete

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Abstract. Self Compacting Concrete (SCC), owing to its advantages, is now a buzz word in the present construction industry. The application of recycled aggregates in concrete mixes is widely investigated. The present investigation focuses on the use of RCA in SCC. The variables of study include grade of concrete (Normal, standard grade and high strength), RCA content (0 to 100%) and age of concrete (7 and 28 days). The parameters of investigation are fresh and hardened state properties, viz. compressive, split tensile and flexural strengths. The mix design was carried out based on modified Nan Su method. The fresh state properties were satisfied for all RCA contents in all the three grades of concretes tested. The test results were encouraging and the target mean strength could be attained in M30 concrete even with 50% RCA as replacement of natural aggregate. However, a reduction in strength was observed as the grade of concrete increased. Optimum RCA content was arrived at based on the strength for different grades of concretes tested.

1. Introduction

The experimental investigations on the recycling of Construction and Demolition Wastes have long been accepted to have the possibility to conserve natural resources and to decrease energy used in production. In some nations it is a standard substitute for both construction and maintenance, particularly where there is a scarcity of construction aggregate. Researches on Construction and Demolished Waste (CDW) reveal that the behaviour of structural concrete with recycled aggregate is comparable to that of the concrete with conventional natural aggregate Manzi et al. [1,2] (2013) The use of such materials solves the disposal problem, apart from reducing the cost of construction materials.

The Indian construction industry today is amongst the five largest in the world and the supply of natural aggregate has also emerged as a problem in some of the metropolis in India. The requirement of natural aggregates is not only required to fulfil the demand for the upcoming future projects in India but also the needs of extensive repairs or replacements required for the existing infrastructure. The future of construction industry sector seems to be in dark with the likely shortage of natural resources as seen today. Several market constraints and technical challenges exist when developing markets for new products. Notable among these barriers is consumer uncertainty about the quality and consistency of products due to the lack of practical performance and engineering data on recycled materials A.R.Khaloo. et al. [3-5] (1996). Such data is necessary to assist with the development of appropriate design codes to guide product specification and performance information on recycled materials.

The concept of self compacting was proposed in 1986 by Professor Hajime Okamura [6] (1997), but the prototype was first developed in 1988 in Japan, by Professor Ozawwa [7] (1989) at the University of Tokyo. In the current research work, mix design adopted is based on Packing Factor (PF) of aggregate proposed by NAN-SU [8] (2001). PF is the ratio of mass of aggregate of tightly packed state in SCC to that of loosely packed state. The workability tests performed in this research were as per EFNARC [9] (2002). Edamatsu et al. [10] (2003) proposed modifications to mix design approach of Okamura. Experimental investigations on RCA concrete [11-16] indicate that there is no effect on strength of concrete compared to that of Conventional aggregate concrete. Recycled aggregate concrete had 7 to 9% lower relative density and 3 to 5 times higher water absorption than that of natural aggregate concrete while there is no effect on strength of concrete for RCA replacements upto 30%. Ajdukiewicz et al. [17] (2002) considered different grades of concrete ranging from M40 to M70 in their study and found that there is a marginal difference in the tensile strength of Recycled Aggregate Concrete (RAC) and Natural Aggregate Concrete (NAC). They also found that the RAC possesses better durability characteristics compared to conventional concrete though the tensile strength is slightly lesser for the former. A marginal decrease was observed in the compressive strength of RCA concrete.

1.1. C&D Waste Management in India

The Indian construction industry is highly labour intensive and has accounted for approximately 50% of the country's capital outlay in successive Five-Year Plans. Out of 48 million tonnes of solid waste generated in India in a year, C&D waste makes up 25%. Projections for building material requirement by the housing sector indicate a shortage of aggregates to the extent of about 55,000 million m^3 [19]. An additional 750 million m^3 of aggregates would be required to achieve the targets of the road sector. But there is a significant gap in demand and supply. Estimated C&D waste generation during construction is 40 to 60 kg per m^2. Similarly, waste generation during renovation and repair work is estimated to be 40 to 50 kg per m^2 as per C&D waste estimation was done by Technology Information, Forecasting and Assessment Council (TIFAC) [18]. The highest contribution to waste generation comes from demolition of buildings which is between 300 to 500 kg per m^2. Therefore in the present study it is proposed to develop low, medium and high strength SCC with RCA.

2. Experimental Program

2.1. Materials used

2.1.1. Cement: Ordinary Portland Cement of grade 53 with specific gravity 3.15 was used in this investigation.

2.1.2. Mineral Admixtures: Fly ash conforming to IS 3812 (Part-1):2003 [21] was used. Chemical composition of fly ash is given in Table 1. It was found that the compressive strength (and workability) of RCA concrete can be significantly improved by adding fly ash to the mixture [1, 3, 4].

2.1.3. Fine and Coarse Aggregates: The physical properties of Sand, NCA and RCA used in the present experimental investigations are tabulated in Tables 2 and 3. The maximum size of coarse aggregate was 12.5 mm. Figure 4 shows the raw RCA obtained from C&D waste concrete and the laboratory Jaw Crusher.

2.1.4. Chemical Admixtures: Super plasticizer (Polycarboxylate Ether based) with specific gravity 1.01 and pH:8, and Viscosity Modifying Admixture (Glenium B233 stream 2) with specific gravity 1.1 and pH:6 were used in this work.

2.1.5. Water: Locally available potable water was used.

Table 1. Chemical composition of Fly Ash

Chemical Property	Loss on Ignition	Alumina (as Al_2O_3)	Silica (as Sio_2)	Iron (as Fe_2O_3)	Calcium (as CaO)	Magnesium (MgO)	Sodium (as Na_2O)	Potassium (as K_2O)
Result	0.43	16.31	60.82	17.17	4.64	--	0.34	0.08

Table 2. Properties of Sand, Natural and Recycled Coarse Aggregate

Property	Sand	NCA	RCA	Method
Type	Natural	Crushed	Crushed	--
Specific gravity	2.62	2.65	2.45	IS:2386 Part-3-1963 [20]
Total water absorption	1.0%	0.3 %	2.4 %	IS:2386 Part-2-1963
Moisture content	0.15%	0.8%	0.45%	IS:2386 Part-2-1963
Bulk Density (Loose)	1567kg/m^3	1380 kg/m^3	1355 kg/m^3	IS:2386 Part-3-1963
Bulk Density (Compacted)	1713kg/m^3	1532 kg/m^3	1540 kg/m^3	IS:2386 Part-3-1963
Fineness Modulus	2.63 (Zone II)	5.94	4.65	IS:2386 Part-2-1963
Elongation Index	--	7.10%	11.27%	IS:2386 Part-2-1963
Flakiness Index	--	6.15%	7.85 %	IS:2386 Part-2-1963

Table 3. Properties of Coarse Aggregate for various proportions of RCA

Property	Percentage of RCA				
	0%	25%	50%	75%	100%
Specific gravity	2.65	2.60	2.53	2.48	2.45
Packing factor	1.12	1.12	1.13	1.13	1.14
Water absorption (%)	0.3	1.0	1.6	2.0	2.4

2.2. Methodology

Modified Nan Su Mix design was used for the design of mixes and then the mix proportions were modified after conducting the workability tests such as Slump flow test, V-funnel test, and L-box test. The modifications were made according to EFNARC guidelines. The mix proportions are given in Table 4. Compressive, split tensile and flexural strengths at the ages of 7 and 28 days were determined.

Table 4. Quantities of different ingredients of various grades of SCC per cum

Grade of Concrete	W/P	Cement (Kg)	Fly ash (kg)	Coarse Aggregate		Sand (Kg)	Admix-ture (kg)	VMA (kg)	Water (lts)
				CA (Kg)	RCA (Kg)				
M30	0.37	407.14	160.43	737.66	0.00	784.49	6.81	0.68	212.00
M50	0.33	489.29	110.60	737.66	0.00	784.49	7.20	0.72	199.00
M70	0.25	710.00	40.19	737.66	0.00	784.49	9.00	0.90	185.00

(Note: Natural Aggregate is replaced with RCA in increments of 25%, i.e., 0%,25%,50%,75% and 100%)

Table 5. Fresh properties of SCC with Different proportion of RCA

Mix Designation	Slump spread in mm	T50 Slump Flow in sec	V-Funnel (T_0) in sec	L- Box Test (h_2/h_1) Test Results
NASCC-M30-0%	720	2.5	8.00	0.95
RASCC-M30-25%	700	3.5	8.28	0.93
RASCC-M30-50%	690	4.0	8.50	0.90
RASCC-M30-75%	680	5.5	8.80	0.88
RASCC-M30-100%	650	6.0	9.00	0.85
NASCC-M50-0%	800	2.5	6.80	0.95
RASCC-M50-25%	780	3.0	7.20	0.93
RASCC-M50-50%	750	3.5	8.50	0.89
RASCC-M50-75%	720	5.5	8.80	0.85
RASCC-M50-100%	680	6.5	9.00	0.80
NASCC-M70-0%	780	3.0	7.50	0.98
RASCC-M70-25%	750	4.0	7.80	0.96
RASCC-M70-50%	720	5.5	8.50	0.90
RASCC-M70-75%	680	6.0	8.00	0.86
RASCC-M70-100%	650	6.5	9.50	0.80

3. Test Results and Discussion

The fresh state properties are given in Table 5. The compressive, split tensile and flexural strengths, for all the three grades of concrete tested, are plotted in Figures 1, 2 and 3 respectively.

3.1. Workability Properties of M 30, M50 &M70 Grade NASCC & RASCC Concrete

3.1.1. Slump cone test results: The natural aggregate has slump flow of 720 mm for M30 grade concrete while the same for 100% RAC is 650. The slump value is found to decrease as percentage of RCA increased in all the grades of concrete tested. Similar trend was observed in M50 and M70 grades also. The slump values ranged between 800 to 680 mm for M50 and 780 mm to 650 mm for M70 grade respectively.

3.1.2. T-50 Slump Flow Results: The natural aggregate has T-50 slump value as 3 sec. There is no appreciable change in the value of T-50 slump flow for all replacements of aggregate for M30, M50 and M70 grades of concretes.

3.1.3. V-Funnel Test Results: The natural aggregate concrete has V-funnel value of 8 sec and it was found to increase with increased percentage of RCA, indicating reduced workability.

3.1.4. L-Box test results: The values of h_2/h_1 were found to decrease with increased percentage of RCA, indicating reduced workability. This is true for all the grades of concretes tested.

3.2. Compressive strength

The compressive strengths of M30, M50 and M70 Grade concretes is observed to decrease with increased recycled aggregate content at all ages. The reduction in compressive strength of M30 grade concrete is less than 10% for 7 days curing while it is about 15% for 28 days curing. However, for M50 grade concrete, the maximum reduction in strength due to the inclusion of RCA is around 20% for 7 days curing while it is about 25% for 28 days curing. This clearly shows that the loss of compressive strength is more in higher grade concretes. The Target strength is reached for M30 grade concrete up to 50% replacement natural aggregate by RCA and beyond 50% replacement there is

marginal deviation from the target strength. However, for M50 grade concrete the target strength could reach only for natural aggregate concrete. As the deviation of target strength is negligibly small, 25% RCA is recommended for M50 grade concrete. For M70 grade, though the design strength is achieved for all the RCA contents including 100% replacement of NA by RCA, target strength could not be attained.

3.3. Tensile strength: The split tensile strength is also found to reduce as the percentage RCA increased in the mix in all the three grades of concrete tested. However, the variation is within 10 to 15% range for M30 and M50 grades while it is 25% in M70 grade concrete tested at 28 days (Figure 2). This clearly shows that the loss of strength is more in high strength concretes when RCA is used.

3.4. Flexural strength: Increased RCA content reduced the flexural strength in all the grades of concrete tested. The reduction in strength as percentage RCA increased is more in all the three grades of concrete at the age of 7 days compared to 28 days age. In M70 grade concrete, the reduction in flexural strength is marginal when tested at the age of 28 days.

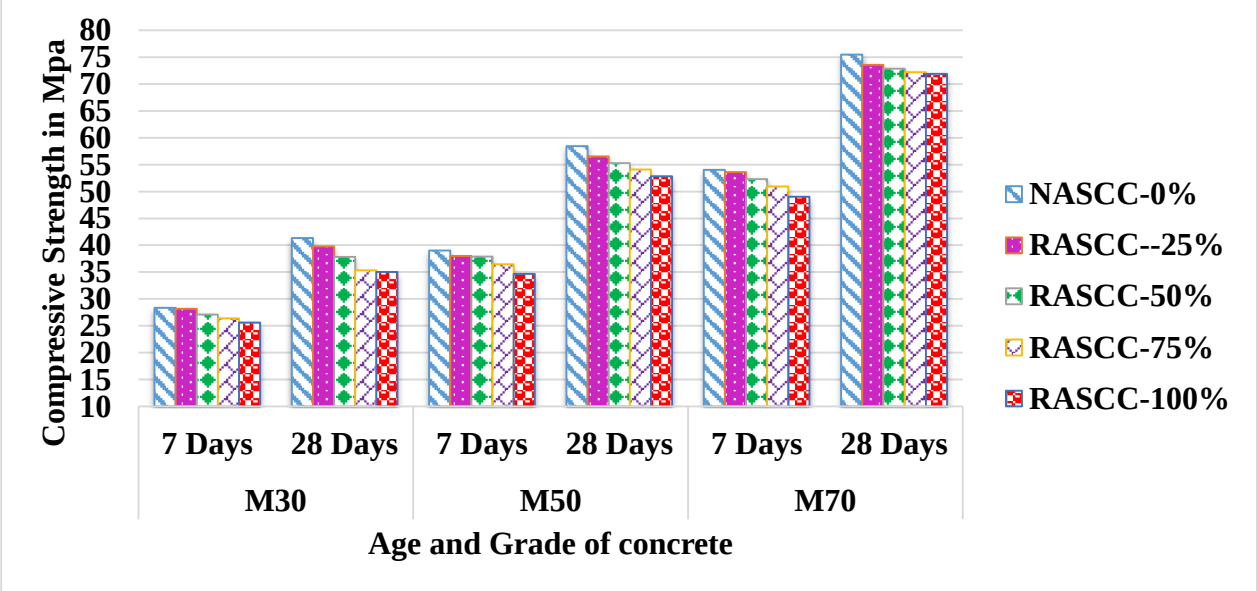

Figure 1. Variation of Compressive Strength with RCA for different grades of concrete and different ages of curing

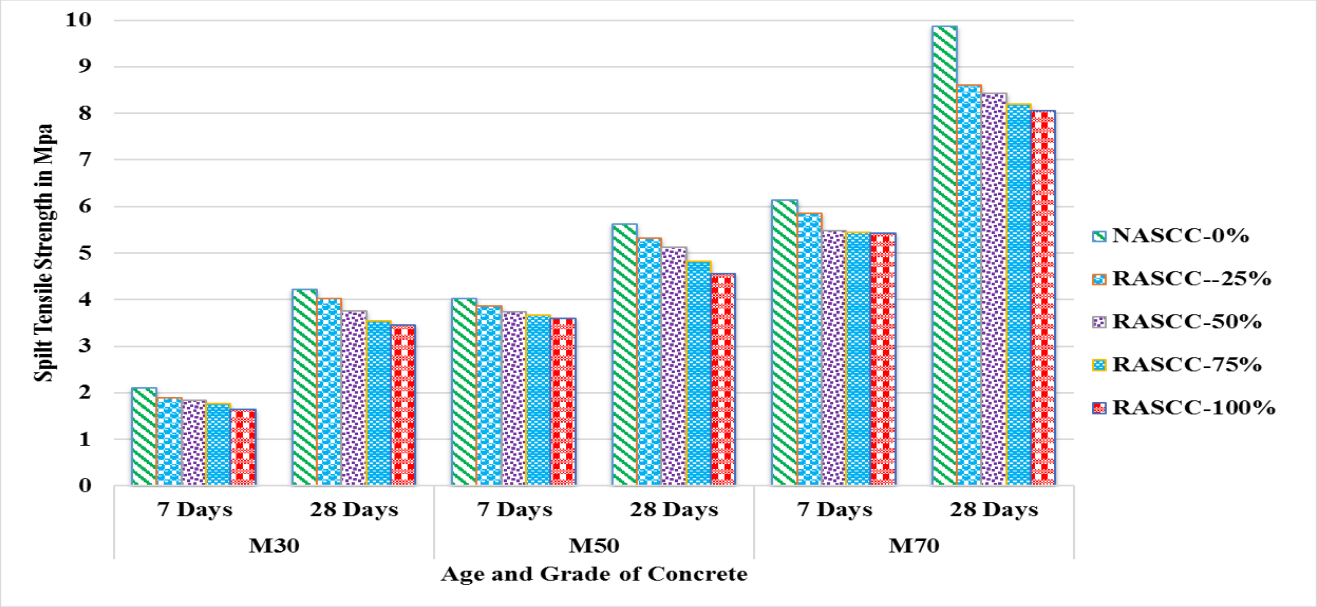

Figure 2. Variation of Split Tensile Strength with RCA for different grades of concrete and different ages of curing

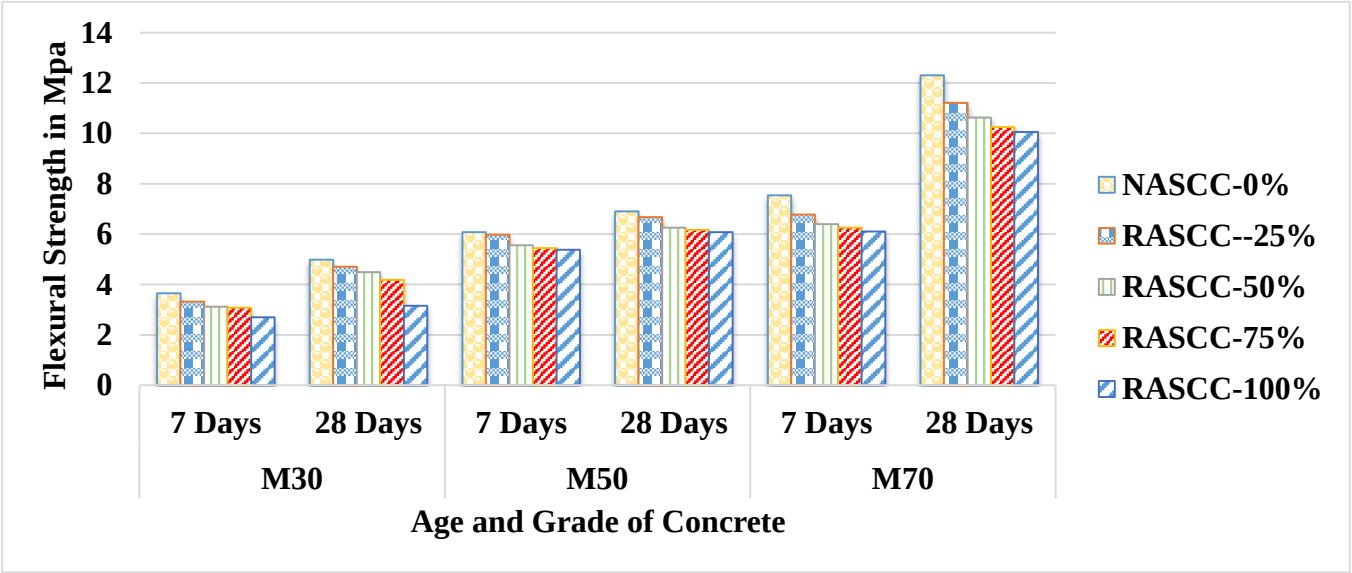

Figure 3. Variation of Flexural Strength with RCA for different grades of concrete and different ages of curing

Figure 4. Demolished Concrete Material and Laboratory JAW crusher

Figure 5. Testing of cubes in UTM

Figure 6. Workability tests for SCC

4. Conclusions

Recycled concrete aggregates can be used for both non-structural and structural concrete. However, based on the studies presented in this paper, it is clear that there is a reduction in the strength of recycled concrete aggregate based concrete and hence it should be blended with natural aggregates for improved properties. The following conclusions are drawn based on the experimental investigations carried out in the present study:

1. The fresh properties requirements of SCC are met with for all the mixes tested, i.e., M30, M50 and M70 grades and all the RCA contents from 0% to 100% as replacement of natural aggregate.
2. The slump spread value reduced with the increase of RCA content in all the grades of concretes tested, indicating reduction in workability.
3. The slump spread value is more for M50 concrete compared to M30 grade. This shows rich mixes are more workable compared to lean mixes. However, higher dosage of super plasticizer is required in high strength concretes to get desired workability.
4. There is not much change in the compressive strengths of RASCC of M30, M50 & M70 grade at 7 days age, for 50% replacement of natural aggregate by RCA. However, the loss of strength of around 14% is observed at the age of 28 days.
5. Split tensile strength and flexural strength of RASCC followed more or less similar trend and the decrease in these values compared to NASCC was found to be around 10%.
6. From the experimental results, it is observed that the optimum percentage replacement of natural aggregate by RCA is 50% to get reasonable strength in compression, tension and flexure.

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Bond Strength of HYSD Bars and SCC with and without Recycled Aggregate-An Experimental Study

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Abstract. Self Compacting Concrete (SCC) has become inevitable in the current scenario of construction of large and complex structures with heavy reinforcement and complicated shapes. Using normal concrete in such situation may often result in inadequate compaction, affecting performance and long-term durability of structures. In addition, the use of Recycled Concrete Aggregate (RCA) is gaining importance throughout the globe due to the depleting sources of natural aggregate and disposal problem of demolished waste. There is a little work done on the behaviour of SCC with RCA. Therefore, a comprehensive experimental investigation on bond strength and modes of failure of Self Compacting Concrete (SCC) with and without Recycled Concrete Aggregate (RCA) was carried out and the results are presented. The variables studied include grade of concrete (M20, M40 and M60), Percentage of RCA (0% to 100%), diameter of bar (10, 12 and 16) and percentage embedment length. All specimens were tested by conducting pull out test on UTM after 28 days of curing. The bond strength was found to vary with the increase in diameter and the failure mode was observed to change from rod pull out to splitting or rod fracture with increase in percentage of embedment length. The experimental results were compared with the theoretical bond strengths using the authors' formula and the formulae suggested by earlier researchers.

1. Introduction

The concept of sustainability is widely used in the construction industry due to the concern about the future of the planet as this industry consumes huge quantities of natural resources. There has been considerable research carried out on the use of recycled aggregates in concrete over the past 20 years, and this has grown extensively over the past five years as industry and Government have recognised the need for greater sustainability in construction. Research has shown that coarse recycled aggregates can be used in concrete up to a compressive strength of 80 MPa although there is a loss in strength when recycled aggregates are used as a direct replacement of natural aggregate. However, most researchers report that a certain proportion of coarse recycled aggregates (usually in the range 20-30% by mass of coarse aggregate) can be added as partial replacement to natural aggregate without affecting performance. The reason for the loss in strength is usually associated with the weaker interfacial transition zone between aggregate and mortar, due to recycled aggregates having a coat of weak mortar already attached which raises the porosity of the concrete. In general, the flexural strength and modulus of elasticity of recycled aggregate concrete have been reported to be proportional to the loss of compressive strength.

One of the greatest technological challenges of the present time is to utiliselarge amount of building and industrial wastes, which are generated as result of the development of the modern society. Whether the waste originates from clearing areas after natural disasters or from human-controlled activities, the utilisation of the waste by recycling will provide opportunities for saving energy, time & natural resources. At present, a very limited amount of building wastes is recycled, and the major portion is being deposited or used as landfill material. With the increase in construction activities and shortage of suitable deposit sites, the building wastes are becoming a serious problem, which has forced the civil engineering professionals and researchers to seriously think and develop methods of reuse of building waste in new construction. From the economic point of view, recycling of building waste is only attractive when the recycled product is competitive with the natural resources with respect to cost and quality.

Okamura and Masahiro [1,2] (2003) carried out investigation for establishing a rational mix design method for SCC. Several authors [3, 4, 5, 6 and 7] investigated on the development of SCC with various materials and different approaches. Jorge and Ricardo Robles [8] (2010) introduced a methodology for predicting long-term properties of recycled aggregate concrete and validated the same based on graphical analysis of the most important properties of hardened concrete. Muhammad Hadi [9] (2008) investigated the bond strength of high strength concrete (M70) with high strength steel (Fe500) with varying diameters of 12 to 36 mm. He proposed a new equation representing the bond based on the test results. How-Ji Chen, et al. [10] (2010) studied the bonding behaviour of Lightweight Aggregate Concrete (LWAC) and normal weight concrete by carrying out experimental investigations. They showed that the difference of the bond failure pattern between the LWAC and normal weight concrete is significant as the compressive strength of concrete is less than 40 MPa. Harajli [11] (2004) undertook a comparative analytical study of the average bond strength at the failure of reinforcing bars embedded in unconfined Normal Strength Concrete (NSC) and High Strength Concrete (HSC). The analysis predicted a highly non-uniform bond stress distribution at bond failure along the development/splice length, particularly for HSC. Below certain limit of the development/splice length (about $15–20d_b$), the average bond strength at failure, normalized to $f_c'^{1/2}$, is larger for HSC as compared to NSC. Ismaeel and James [12] (2013) studied the effect on bond strength when the reinforced steel bars are polluted (oiling the bars). The study was carried out for two embedment lengths and for two modes of polluting the bars. They found that no slip failure occurred in testing all the polluted and non-polluted bars and small bar sizes have greater bond strength than large bar sizes when the embedded length is small. They also observed that the embedment length of the bar greatly affects the bond strength especially for bars of small diameter. Liam, et al. [13] (2015) concluded that as the bonded length increases, the surface area over which the reinforcing bar is bonded to the concrete increases. Thus larger bar forces can be sustained before the tensile hoop stresses developed in the concrete exceed the tensile strength of the concrete causing splitting, slip and bond failure.

1.1. Significance

In the recent years, demand for the natural aggregate has increased enormously due to rapid urbanisation and extensive construction activity. There is a need to find a solution to protect or to conserve the natural aggregate for the coming generations. Therefore, search for the alternative material to natural aggregate started in the recent decades. Nowadays, Self-Compacting Concrete (SCC) is being used in almost all major projects due to its many advantages. But It is very important that we need to understand the behaviour thoroughly of any new material before putting it into use. Therefore, in this project, the bond characteristics of the HYSD reinforced bar with SCC made with and without recycled aggregate are investigated.

2. Experimental Program

2.1. Materials used

2.1.1. Cement: Ordinary Portland Cement conforming to IS 12269:1987 with specific gravity 3.15 was used in this investigation. The physical properties and chemical composition of cement are given in Tables 1 and 2 respectively.

2.1.2. Mineral Admixtures: Fly ash conforming to IS 3812(Part-1):2003 was used. The chemical composition of fly ash is given in Table 3.

2.1.3. Coarse Aggregates: Natural aggregates with a maximum size of aggregates 12.5 mm conforming to IS 383:1970 & Recycled Concrete Aggregate (RCA) of maximum size 12.5 mm, obtained from demolished building, were used.

2.1.4. Fine Aggregates: Locally available sand conforming to Zone-II was used. The properties of fine and coarse aggregates are given in Table 4.

2.1.5. Chemical Admixtures: Superplasticizer (Polycarboxylate Ether based) with specific gravity 1.01 and pH:8, and Viscosity Modifying Admixture (GleniumB233 stream 2) with specific gravity 1.1 and pH:6 were used in this work.

2.1.6. Water: Locally available potable water was used.

Table 1. Physical properties of cement

Property	Value
Specific gravity of cement	2.92
Initial setting time	32 min
Final setting time	185 min
Normal consistency	30 %
Compressive strength	54.7 N/mm^2

Table 2. Chemical composition of cement (as per Manufacturers test report)

S.No.	Chemical Property	Limits (as per IS)	Results
1	Lime Saturation Factor (%)	0.66 to 1.02 (max)	0.82
2	Alumina Iron Ratio	Min 0.665%	1.2%
3	Insoluble Residue	Max 2%	0.95%
4	Magnesia (%)	Max 6	2.4
5	Sulphuric Anhydride	2.5 to 35%	1.1%
6	Loss on Ignition	Max 5%	2.2 %

Table 3. Chemical composition of fly ash

S.No.	Chemical Property	Result (% mass)
1	Loss on Ignition	0.43
2	Alumina (as Al_2O_3)	16.31
3	Silica (as Sio_2)	60.82
4	Iron (as Fe_2O_3)	17.17
5	Calcium (as CaO)	4.64
6	Magnesium(MgO)	Not found
7	Sodium (as Na_2O)	0.34
8	Potassium (as K_2O)	0.08

Table 4. Properties of Sand, Natural Coarse Aggregate and Recycled Concrete Aggregate

Property	Sand	NCA	RCA
Specific gravity	2.59	2.81	2.35
Total water absorption	1.0%	0.3 %	2.40%
Moisture content	0.15%	0.8%	0.45%
Bulk Density (Loose)	1567kg/m^3	1380 kg/m^3	1355 kg/m^3
Bulk Density (Compacted)	1713kg/m^3	1530 kg/m^3	1590 kg/m^3
Fineness Modulus	2.39 (Zone III)	6.36	6.35
Elongation Index	--	7.10%	15.5%
Flakiness Index	--	6.15%	5.8 %

2.2. Mix Proportioning of SCC with Natural Aggregates (NASCC) and Recycled Aggregates (RASCC)
The mix proportioning was done based on the Modified Nan Su approach and the quantities of various ingredients are given in Table 5.

Table 5. Quantities of different ingredients of various grades of RASCC & NASCC per cum

Mix identification	Cement (Kg)	Fly ash (kg)	Coarse Aggregate		Sand (Kg)	Admix-ture (kg)	VMA (kg)	Water (lts)
			CA (Kg)	RCA (Kg)				
NASCC- M20	338.57	219.11	737.66	0.00	784.49	6.69	0.67	218.00
RASCC- M20	338.57	219.11	368.83	368.83	784.49	6.69	0.67	222.00
NASCC-M40	445.71	143.54	737.66	0.00	784.49	7.07	0.71	204.00
RASCC-M40	445.71	143.54	368.83	368.83	784.49	7.07	0.71	208.00
NASCC-M60	570.00	59.92	737.66	0.00	784.49	7.56	0.76	187.00
RASCC-M60	570.00	59.92	368.83	368.83	784.49	7.56	0.76	191.00

2.3. Experimental Methodology
The experimental procedure involves casting and testing of cubes, prisms and cylinders for the compressive, flexural, and split tensile and bond strengths respectively. The variables of the investigation include RCA content, the diameter of bar and embedment length of the bar for bond studies. The RCA content was varied as 0% and 50% by weight of the natural aggregate. For each cylinder cast, steel reinforcement with three different diameter bars of 10 mm, 12 mm and 16 mm was used with four different embedment lengths of 75 mm, 150 mm, 225 mm and 300 mm respectively. To maintain the verticality of the bar, wooden ‘c’ shaped clamps were prepared to make them exactly fit the cylindrical mould with a hole at the centre of the top strip for inserting the reinforcement bar. The bar was inserted to the required embedment length and fixed (Figure 1). The next day of casting, moulds were removed, and the respective cylinders and cubes were placed in the curing tank for 28 days. For the cylinders pull out the test was carried out on Universal Testing Machine of 1000 kN capacity. An extensometer was fixed to the rod and a dial gauge was also used to measure any possible slip. The arrangement is shown in Figure 2.

Figure 1. Cylindrical moulds with a wooden channel to support steel rod

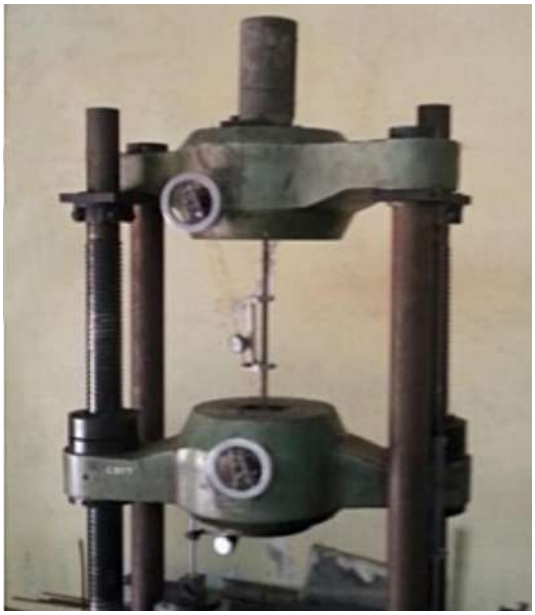

Figure 2. The test set up for pull out test

3. Test Results and Discussions

3.1. Workability

The fresh state properties of concrete are shown in Table 6. The workability is found to decrease, in all the grades of concrete tested, with the introduction of 50% of recycled aggregate as partial replacement of natural aggregate. However, the values of different workability tests are within the acceptable limits as given by EFNARC. The workability properties improved with the grade of concrete. This improvement is due to the presence of higher cement paste in rich mixes.

Table 6. Workability properties of RASCC & NASCC (M20, M40 & M60 Grades)

Grade of Concrete	Mix Identification	Flow Table	T50	V-Funnel Test (Sec)		U- Box Test	L- Box Test
		(mm)	(Sec)	T0	T5	(mm)	(h2/h1)
		650-800	2 -5	6 -12	6 -15	0-30	0.8-1.0
M20	NASCC-M20-0%	690	2.0	6.5	11.5	28	0.96
	RASCC-M20-50%	674	4.0	7.2	10.2	25	0.86
M40	NASCC-M40-0%	780	3.0	6.3	10.4	28.5	0.94
	RASCC-M40-50%	760	4.5	6.8	8.9	25.8	0.85
M60	NASCC-M60-0%	800	3.0	6.5	10.8	28.5	0.95
	RASCC-M60-50%	762	4.5	7.2	10.2	24.5	0.85

3.2. Hardened state properties

The compressive, split tensile and flexural strengths at the ages of 7 days and 28 days are shown in Table 7. In general, as 50% of the natural aggregates are replaced by recycled coarse aggregates, there is a reduction in strengths of all the grades of concrete tested. However, the reduction is marginal and is within 10 to 15% range. The calculated bond stress values, using authors' formula, Orangun and Darwin formula for M20 grade concrete with different diameters of bars and different lengths of

embedments are shown in Figures 1 and 2. Similarly, the experimental bond stress values and theoretical values for M40 and M60 grades of concrete are shown in Figures 3 to 6.

Table 7. Strength results of NASCC & RASCC with Different proportions of RCA

Mix	Mix identification	Compressive Strength (MPa)		Spilt Tensile Strength (MPa)		Flexural Strength (MPa)	
		7 Days	28 Days	7 Days	28 Days	7 Days	28 Days
Low Strength	NASCC-M20-0%	22.10	34.25	2.8	3.8	3.2	4.1
	RASCC-M20-50%	20.85	32.93	2.3	3.3	2.7	3.6
Medium Strength	NASCC-M40-0%	32.86	53.6	6.13	9.86	7.54	12.31
	RASCC-M40-50%	30.97	50.3	5.48	8.43	6.39	10.63
High Strength	NASCC-M60-0%	50.85	70.25	5.3	9.27	6.97	8.1
	RASCC-M60-50%	48.2	68.1	4.8	7.15	5.71	7.79

For 150 mm and 225 mm embedment length, the concrete split vertically up to the tip of the rod due to the radial pressures acting around the surface of the rod and normal to it (figures 3 and 5). This splitting failure may be attributed to the fact that the higher tensile strength in the bar, the higher compressive strength of matrix and higher bond strength between the bar and matrix, led to the initiation of crack in the cylinder due to the radial stress exceeding the tensile strength of concrete. This has subsequently led to the vertical splitting of the cylinder from the tip of the bar. For 300 mm embedment length, as the rod tends to pull out of the concrete, radial pressure acts around the surface of the rod and normal to it that leads to splitting of the specimen vertically into two pieces (figure 4). In all the three cases concrete splitting was observed, indicating that the stress in concrete had exceeded its maximum permissible limit before the tensile stress in steel reached the yield strength. However, the failure of specimens with 12 mm bar with 300 mm embedment was by steel rupture (figure 6). The bond strength was observed to improve when recycled aggregate is used in all the grades of concrete tested (figures 2, 4 and 6).

With the increase in the percentage length of embedment, bond stresses are increasing up to 225 mm of embedment, and on further increase in embedment length, a drop in the values of bond stress is observed (figures 1 to 6). The drop in the bond strength is due to the mode of failure changing to splitting. Bond stress curves followed the same pattern with the usage of 50% recycled aggregate.

3.3. Model calculations

3.3.1. Experimental Bond stress calculation: For M20 grade of concrete, 12 mm rod with 300 mm as depth of embedment.

$$u = \frac{p}{\pi dlu} = \frac{81000}{(\pi \times 12 \times 300)} = 7.16 \text{N}/mm2 \quad (1)$$

3.3.2. Orangun Formula: For M20 grade of concrete, 10 mm rod with 300 mm as the depth of embedment.

$$\text{Bond Stress } 'u' = 0.083045\ (\text{f}_\text{c}\left[1.2 + 3\ \frac{\text{c}}{\text{d}} + 50\frac{\text{d}}{\text{l}}\right])^{\frac{1}{2}} \quad (2)$$

$$u = 0.083045\ \left(20\left[1.2 + 3\ \times \frac{70}{10} + 50\ \times \frac{10}{300}\right]\right)^{\frac{1}{2}} = 8.86\ N/mm^2 \quad (3)$$

3.3.3. Darwin Formula: For M20 grade of concrete, 10 mm rod with 300 mm as the depth of embedment

$$\text{Bond Stress } 'u' = 0.083045 \left(f_c \left(1.06 + 2.12 \times \frac{c}{d}\right)\left(0.92 + 0.08 \frac{Cmax}{Cmin}\right) + 75 \times \frac{d}{l}\right)^{\frac{1}{2}} \quad (4)$$

$$u = 0.083045 \left(20 \left[\left(1.06 + 2.12 \times \frac{70}{10}\right)\left(0.092 + 0.08 \frac{70}{70}\right) + 75 \times \frac{10}{300}\right]\right)^{\frac{1}{2}} = 6.83\ N/mm^2 \quad (5)$$

3.4. Empirical model proposed to estimate the Bond stress of NASCC & RASCC different grades of concrete with different proportions of RCA

Regression analysis was carried out on the experimental data considering the grades of concrete, percentage of recycled aggregates, reinforcing bar diameters and their percentage of embedment as independent variables (x1, x2, x3 and x4 respectively) and bond stress (y) as dependent variable. The following formula is obtained:

$$y = 6.28 + 0.05 \times x1 + 0.007 \times x2 + 0.11 \times x3 - 0.02 \times x4 \quad (6)$$

Where $'y'$ is the bond stress (concrete and HYSD bars)
x1- the grade of concrete,
x2- The percentage of recycled aggregate mixed in the concrete
x3- reinforcing bar diameter,
x4-The percentage length of embedment of reinforcing bar

The figures 1 to 6 show theoretical bond stress computed as per the authors' formula and earlier authors' formulae and also the experimental bond stress values for the three grades of concrete (with and without RCA) M20, M40 and M60 respectively. It is evident from the curves (figures 1 to 6) that the authors' formula is giving closer values to the experimental values compared to earlier authors' formulae.

Figure 3. Splitting failure for 16 mm dia. bars embedded up to 150 mm in M60 concrete

Figure 4. Steel rupture Mode of failure for 12 mm diameter bars embedded to 300 mm.

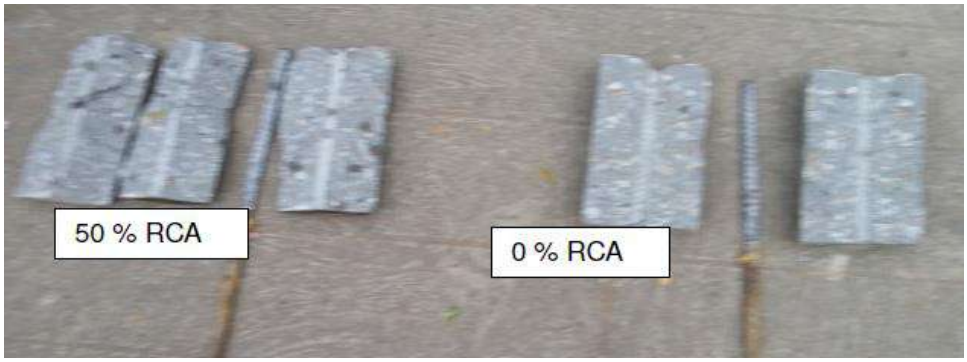

Figure 5. Splitting Mode of failure for 16 mm diameter bars embedded upto 300 mm length in M60 concrete with 0% and 50% RCA.

Figure 6. Splitting Modes of failure for 16 mm diameter bars embedded into various lengths of M60 concrete cylinders with 50% RCA.

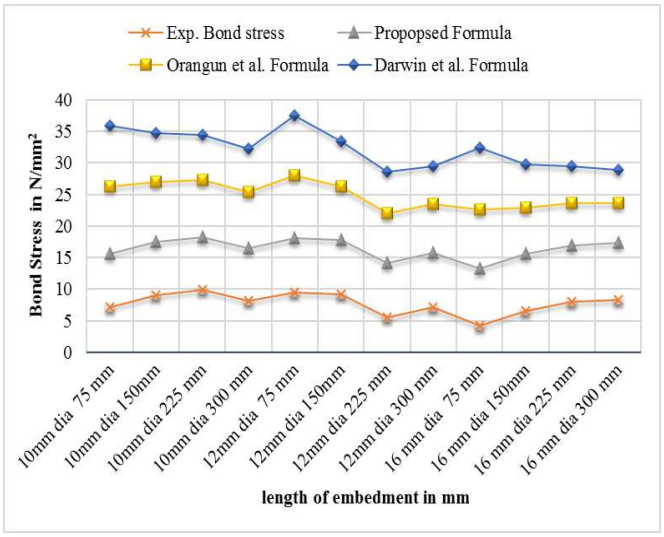

Fig 7. Bond Stress Vs Percentage embedment lengths for different bar diameters (SCC M20-0%RCA)

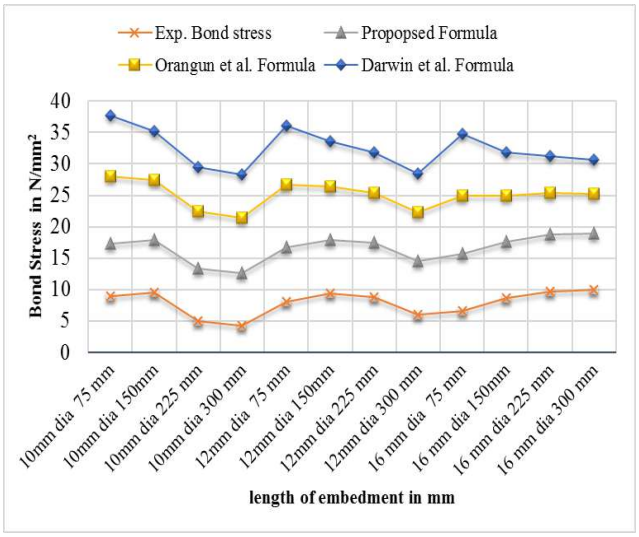

Fig 8. Bond Stress Vs Percentage embedment lengths for different bar diameters (SCC M20-50%RCA)

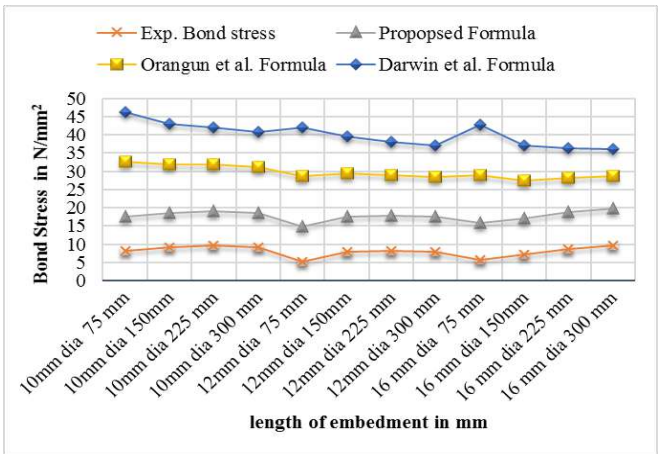

Fig 9. Bond Stress Vs embedment lengths for different bar diameters (SCC M40-0%RCA)

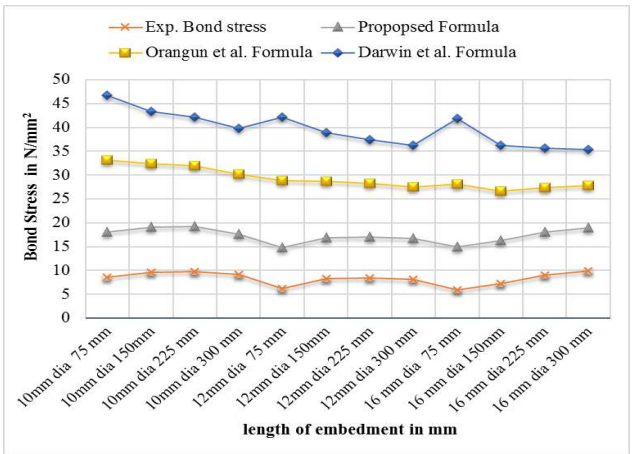

Fig 10. Bond Stress Vs embedment lengths for different bar diameters (SCC M40-50% RCA)

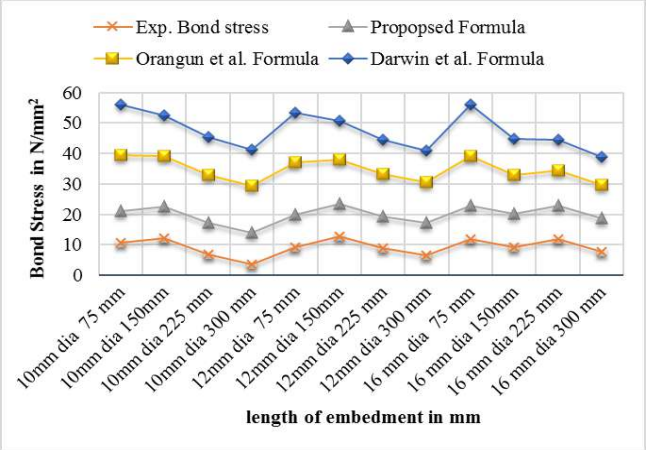

Fig 11. Bond Stress Vs Percentage embedment lengths for different bar diameters (SCC M60-0%RCA)

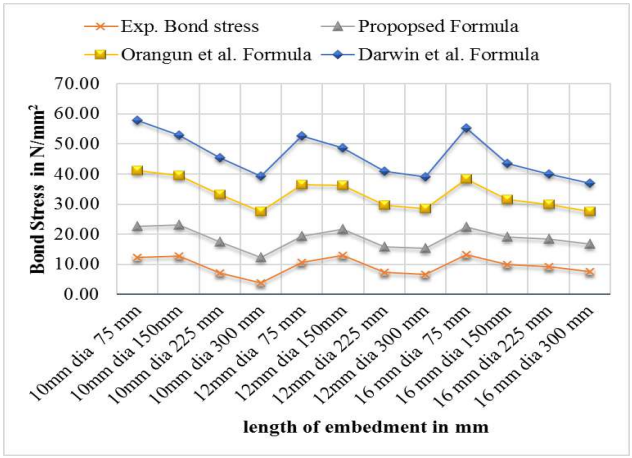

Fig 12. Bond Stress Vs Percentage embedment lengths for different bar diameters (SCC M60-50%RCA**)**

4. Conclusions:

1. The specimens with 75 mm embedment length failed by pull out for M20 grade concrete with or without recycled aggregate.
2. The bond strength of concrete with steel is found to increase as the diameter of bar increased from 10 mm to 12 mm and again there is a drop in bond strength for 16 mm diameter bar.
3. The failure pattern changed from rod pull out to either bar failure or splitting of concrete as embedment length increased due to the increased bond resistance.
4. Bond stress values are increasing with the increase in depth of embedment up to 225 mm of embedment in M20 and M40 grade concretes while it is increasing up to 150 mm embedment length in M60 concrete.
5. Recycled aggregate concrete showed higher bond stress when compared to natural aggregate concrete.
6. The authors' formula can be used to calculate the bond stress of HYSD bars with concrete of different grades (M20, M40 and M60).

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