Department of Computer Science and Engineering
National Institute of Technology Calicut

NIT Campus (PO), Calicut-673601, India

DCC Meeting Minutes

Date: 27/04/2021 Time: 12:15 PM to 1:00 PM Venue/Mode: Online

Agenda:

1. **Ratification of the minutes of the DCC meetings held on 22/02/2021 and 23/02/2021**
2. **Permission to allow Yash Varshney (M180279CA) to do his final semester project at Tata Consultancy Services.**
3. **M.Tech CSE (AI & DA) Programme Proposal - Reg.**
   a) **Faculty Coordinator for the programme.**
   b) **Syllabus preparation.**
4. **Proposal for M.Tech CSE (AI&DA) to be placed in BOG.**
5. **Consideration of the proposal from Chairperson UG admission for revising DASA/CIWG seat matrix considering the increased B.Tech/B.Arch intake and demand for various branches in past 5 years**
6. **Proposal from SAC for the inclusion of another-branch SAC Branch Representative in Class Committee meetings.**
7. **Proposal from the Department regarding Internal Revenue Generation**

The DCC meeting started online at 12:15 PM on 27/04/2021. The Chairperson welcomed all the members to the meeting.

Agenda Item 1: Ratification of the minutes of the DCC meetings held on 22/02/2021 and 23/02/2021

The DCC ratified the approval of the minutes of the DCC meeting held on 22/02/2021 and 23/02/2021

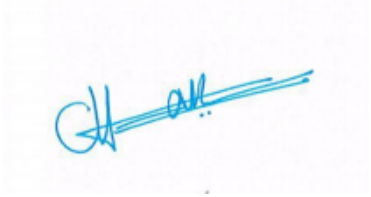
Agenda Item 2: Special permission to allow Mr. Yash Varshney (M180279CA) to do his final semester project at Tata Consultancy Services.

The DCC approved the request.

Agenda Item 3: M.Tech CSE (AI & DA) - Reg.

a) Appointment of Faculty Coordinator

The HOD, CSED proposed Prof. K. A. Abdul Nazeer as the coordinator for the new M.Tech CSE (AI & DA) programme. The DCC approved the proposal.



b) Syllabus preparation.

Dr. Lijiya updated the DCC of the status of progress in the work. The DCC requested the faculty team members to complete the syllabus as early as possible.

Agenda Item 4: Proposal for M.Tech CSE (AI & DA) to be placed in BOG.

The Proposal was presented by Prof. K. A. Abdul Nazeer. The DCC approved the proposal with the following comment that the intake of the M.Tech (AI & DA) programme may be reduced to a minimum number initially and may be raised gradually. Based on the opinions expressed by the members, DCC suggested that the possibility of offering a few seats under the 'self-sponsored category' may be explored at a later stage. The proposal is attached in *Annexure I.*

Agenda Item 5: Consideration of the proposal from Chairperson UG admission for revising DASA/CIWG seat matrix considering the increased B.Tech/B.Arch intake and demand for various branches in past 5 years

The DCC deferred discussion on the item.

Agenda Item 6: Proposal from SAC for the inclusion of another-branch SAC Branch Representative in Class Committee meetings.

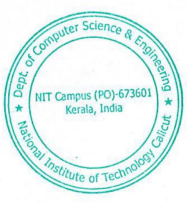
The DCC deferred discussion on the item.

Agenda Item 7: Discussion on Internal Revenue Generation

The HOD, CSED presented this item with a draft proposal. The proposal is attached in *Annexure II*. The DCC approved the proposal with some additional comments as follows:

a) The DCC suggested that the proposal may include a suggestion that the institute may create a provision to allow contributions from alumni and other stakeholders to the Department.
b) There may be a provision to admit students to M.Tech programme in self financed category and the department share of the fee revenue generated from such seats may be credited to the Department Development Fund (DDF).
c) The institute may facilitate departments to initiate a trust/forum through which contributions from alumni/industry/parents to the department for student scholarships, conduct of training programmes, social outreach activities or DDF contributions may be raised

The meeting concluded at 1:02 PM on 27/04/2021.



ANNEXURE I

Proposal for

M.Tech Program in Computer Science and Engineering

(Artificial Intelligence & Data Analytics)

Submitted by

Department of Computer Science and Engineering

National Institute of Technology Calicut

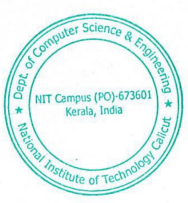
INSTITUTION: **National Institute of Technology Calicut**

DEPARTMENT/SCHOOL: **Computer Science and Engineering**

DEGREE PROGRAM: **M. Tech CSE (AI & DA)**

PROJECTED DATE OF IMPLEMENTATION: **July 2022**

INTAKE OF STUDENTS : **15**



1. About of the Program

With the emergence of Artificial Intelligence (AI) back in the limelight, coupled with the availability of huge chunks of data in diverse fields, life is becoming more and more oriented towards Machine Learning (ML) and Data Science (DS). The world is fast moving from IoT (Internet of Things) to IoE (Internet of Everything), with millions of people connected by mobile devices. Availability of unprecedented processing power, storage capacity and access to enormous data opens up boundless possibilities. The 'fourth industrial revolution' characterized by the fusion of technologies that is blurring the boundaries between physical, digital and biological fields, calls for *intelligent* solutions in all spheres of life. In the backdrop of such a scenario, when the world is *"drowning in data, but starving for knowledge"*, a harmonious blend of AI and Data Analytics (DA) tends to offer promising computational solutions for problems in diverse fields of activities such as life science, education, health and medical science, climate and environment, web and social media, finance, and agriculture.

The massive data that have been generated out of various scientific experiments using the latest developments necessitated specialized and efficient mathematical and computational models to mine useful knowledge from these 'big data', which is not manually possible. AI and ML techniques facilitate data analysis through automated analytical model building, which is based on the idea that machines should be able to learn and adapt through experience. The recent developments like self-driving cars, satellite imagery analysis to address climate change or identify regions of better agricultural yield, business intelligence, online recommendation systems, fraud detection, sentiment analysis of Twitter data, computer vision using Deep Learning, and similar developments are evidence of the growing demand for experts in this field. AI and DA play a pivotal role in the Health Care sector as well which include biomedical image and data analysis for early and accurate prediction of diseases, enabling precision diagnosis and treatment, rapid detection of future pandemics, computer aided drug discovery, and analysis of pandemic data for efficient management of diseases like COVID-19. With the ever-growing investments in the field of AI, and the emergence of Big Data technologies, there will be high demand for 'AI and Data Analytics' engineers in the coming years as well.

In the present day scenario, most of the IT/ITES industries are using AI/ML techniques for their business. This creates a high demand for qualified undergraduate/postgraduate/Ph. D/post doctoral level trained manpower in AI at various levels of their organizational structure. Various research institutes are also in need of this manpower for their flagship research works.

Only very few top-tier higher educational institutes in India are offering Master's programs in AI and Data Analytics. Definitely these programmes are not sufficient to meet the skill set requirements of various research or governmental organizations in India and Indian IT related Industries. Also the undergraduate students who are really motivated to continue their studies/research in these fields are really huge in number and many of them have to drop their dreams due to insufficient availability of such programmes in India. Considering the above facts, the proposed 2 year M. Tech degree programme in CSE with special emphasis to AI and Data Analytics, has great relevance in India especially in a Government funded Institute like NIT Calicut.

This programme is proposed to be offered for graduates from any branch of Engineering and post-graduates from any field of Science, having a special interest in CSE in general and AI & Data Science in particular. In this way, this programme will be a unique learning experience for the students coming from multidisciplinary fields of Engineering, Science and Technology which is deemed as the need of the hour.

Benefits that will be acquired by the students who will pursue the programme:

a) The proposed program is a two year Master's degree in technology. The program is designed to admit students with background in multiple disciplines and is designed to be a multidisciplinary programme bringing together ideas from statistical learning theory and computer algorithms to solve problems in big data analytics. [Ref: Eligibility Criteria - Annexure 1]
b) The programme exposes students to one of the most actively pursued domains in engineering - Artificial Intelligence, Machine Learning and Big Data Analytics, for which there is high industrial demand. [Ref: Scope for Employment - Annexure 2]
c) The curriculum has been designed in consultation with experts from both the industry and academia. The curriculum, while providing a balanced coverage of the theoretical foundations of the subject, places heavy emphasis on the engineering practice and focuses on rigorous laboratory practice that suits the industrial requirements. The curriculum also provides sufficient flexibility to the student to specialize in diverse directions by choosing elective courses of her/his interest. [Ref: (i) Proposed Curriculum - Annexure 3 (ii) Comments and suggestions from Department Advisory Board Members - Annexure 4].

2. Rationale for the Program

Institutional Rationale (Alignment with Institutional Mission and Vision)

1. The programme will contribute graduates with high technical ability and professional conduct who are well-trained engineering graduates who can immediately contribute to the industrial workforce of the nation and to the progress of the society. Hence, the programme is aligned with the vision and mission of the institution. [Ref: Programme Educational Objectives and Programme Outcomes - Annexure 5]
2. The Department of Computer Science and Engineering has adequate faculty expertise with seven faculty members having done their Ph.D work in the areas of data science, machine learning, bioinformatics and computer vision, and several other faculty members who have collaborative work in the field. [Ref: List of Faculty with Ph.Ds in the field of Artificial Intelligence and Data Analytics and their publications - Annexure 6]
3. Since the areas of artificial intelligence, machine learning and data analytics are of high industrial and scientific importance, the institute expects that all graduates of the programme will be offered industrial internships or internships at R&D organizations in the second year of their programme, opening up avenues for industrial collaborations and funded research projects. Thus, the programme is expected not only to produce quality graduates meeting the demands of the industry, it is also expected to foster the growth of the institute by contributing to the R&D funding of the institution.
4. Aspiring graduates are expected to pursue Ph.D in the field, in India and abroad - including major institutions in India such as Indian Institute of Science, IITs and NITs - all of which admit Ph.D students in the areas of data science, machine learning and artificial intelligence. [Ref 6: Advertisements for people in the area from a first tier institution]

3. Cost and Support for the Program

i. *Faculty and Staff Requirements.*

Year 1: 1 faculty member & 1 technical staff.*

Year 2: 2 faculty members & 2 technical staff.*

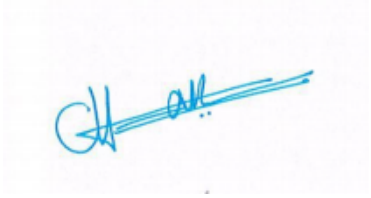
ii. Infrastructure Requirements.

Year 1: One class room*

Year 2: One class room & one laboratory.*

iii Budgetary Requirements.

Details of Expenditure	YEAR 1 (Amount in Lakhs)	YEAR 2 (Amount in Lakhs)



Faculty (1 + 2)	10.80*	21.60*
Staff (1 + 2)	6.0*	12.0*
Scholarship to the students (@Rs. 12400)	22.32	44.64
Equipment	0	25*
Total	**39.12***	**103.24***

*1. The department expects a high percentage (over 50%) of students to be offered one year industrial internships allowing students to undertake their final year project with the industry. For such students, scholarships are not provided by the institution, and hence there will be further reduction in the financial commitments required for second year graduate students.

2. After the establishment of the proposed programme, the department proposes to commence an Executive M.Tech Programme in the same area (AI and Data Analytics), which can substantially contribute to the IRG of the Institute.

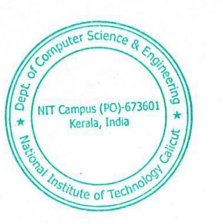
4. Similar and Related Programs in other institutions.

Sl No.	Name of Institute	Name of Program & Offering Dept.	Eligibility	Curriculum
1	Carnegie Mellon University	Master of Computational Data Science, CS	NA	https://mcds.cs.cmu.edu/learn-us-curriculum

2	IISc Bangalore	MTech (AI), Jointly by Electrical, Electronics and Computer Sciences (EECS) https://eecs.iisc.ac.in/mtechai/	BE/ BTech or equivalent degree (with a GATE paper in CS, EE ,EC) Candidates should have done a formal course in Programming in C and C++	https://eecs.iisc.ac.in/wp-content/uploads/2020/10/MTechAICurriculumOctober1st.pdf
3	IISc Bangalore	M.Tech (Computational and Data Sciences) Department of Computational and Data Sciences) http://cds.iisc.ac.in/wp-content/uploads/MTech_CDS_Brochure_final.pdf	BE /B Tech/M Sc/MCA/Four year B.S. or equivalent in any discipline of science/engineering (with a valid GATE Score). Strong Mathematical and Programming background is required	http://cds.iisc.ac.in/academics/mtechcds/
4	IIT Ropar	M.Tech in Artificial Intelligence CSE https://www.iitrpr.ac.in/information-about-mtech-artificial-intelligence	Candidates with BTech/BE/MCA or MSc in the appropriate area with valid GATE Score in Computer Science and Information Technology (CS)	https://www.iitrpr.ac.in/information-about-mtech-artificial-intelligence

5	NIT Trichy	M.Tech in Data Analytics Department of Computer Applications https://www.nitt.edu/home/academics/departments/ca/programmes/mtech/	Not available	https://www.nitt.edu/home/academics/departments/ca/programmes/M.Tech.%20DA%20Syllabus1.pdf
6	IIT Hyderabad	M.Tech (Artificial Intelligence) Dept. of Artificial Intelligence, IIT Hyderabad	B.Tech/B.E/M.Sc/ Equivalent degree in any discipline	https://ai.iith.ac.in/mtech-admissions.html
7	IIT Guwahati	M.Tech in Data Science An interdisciplinary M. Tech. Programme jointly offered by three departments – CSE, EEE and Maths https://www.iitg.ac.in/ds/	Valid GATE score in CS, EC, EE, IN, MA, ST or XE	https://www.iitg.ac.in/ds/#curriculum

ANNEXURE 1



Eligibility Criteria

Bachelor's degree of four years duration in any branch of Engineering/Technology ***OR*** *Master's degree of two/three years duration in any stream of Science / Mathematics / Statistics / Computer Science / Computer Applications, from a recognized university/institute, with minimum 60% marks or CGPA of 6.5 (55% marks or CGPA of 6 for SC/ST candidates)*

AND

A valid GATE score in Computer Science and Information Technology ***OR*** *Electronics and Communication Engineering* ***OR*** *Electrical Engineering* ***OR*** *Mathematics* ***OR*** *Statistics.*

ANNEXURE 2

Scope for Employment

Employment sectors to which the post graduates in M.Tech-CSE (AI & DA) could look for gainful employment

a) Research Institutes, Universities, and R&D Labs in India and abroad conducting research in the field.

b) Industries like Amazon, Google, and Microsoft. Many Start-ups inside India and abroad are recruiting qualified AI/DA graduates/post graduates now-a-days and presently there is a lack of talent pool in this area.

c) Government of India organizations.

ANNEXURE 3

Proposed Curriculum

Department of Computer Science and Engineering

National Institute of Technology Calicut

Proposed M.Tech. Programme in

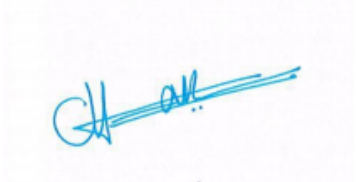
Computer Science and Engineering (Artificial Intelligence & Data Analytics)

Semester 1

Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical/ Seminar (P/S)	Credits
CS 6172D	Artificial Intelligence	3	0	2	4
CS 6191D	Mathematical Foundations of Machine Learning	4	0	0	4
CS 6301D	Introduction to Data Analytics	3	0	2	4
	Elective	3/4	0	2/0	3/4
Total Credits					**15-16**

Semester 2

Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical/ Seminar (P/S)	Credits
CS 6192D	Machine Learning	4	0	0	4



CS 6393D	Machine Learning Laboratory	1	0	6	4
	Elective	3/4	0	2/0	4
	Elective	3/4	0	2/0	3/4
Total Credits					**15-16**

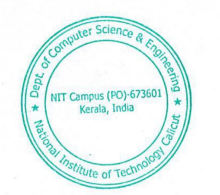
Semester 3

Course Code	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical/ Seminar (P/S)**	**Credits**
CS 7398D	Project	--	--	20	14
Total Credits		--	--		**14**

Semester 4

Course Code	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical/ Seminar (P/S)**	**Credits**
CS 7399D	Project	--	--	28	16
Total Credits		--	--		**16**

Note:



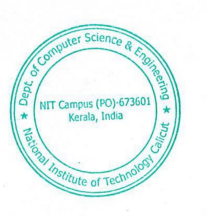
(i) A Candidate should have earned a total of at least 60 credits, including 30 credits from the project work.
(ii) Credits for elective courses may vary depending on the practical work involved.
(iii) A student can credit as an elective any *relevant* course offered for M. Tech or Ph.D students in other streams/departments, with permission from the Programme Coordinator.
(iv) *CS 6103D Software Systems Laboratory* can be credited as an elective course in the first semester.
(v) *CS 6317D Term Paper* can be credited as an elective course in the second semester.

List of Elective Courses

Sl. No.	Course Code	Course Title	Credits
1	CS 6155D	Topics in Data Analytics	4
2	CS 6302D	Information Retrieval	4
3	CS 6303D	Statistical Foundations of Data Science	4
4	CS 6304D	Advanced Deep Learning and Computer Vision	4
5	CS 6305D	Neural Networks and Deep Learning	4
6	CS 6306D	AI in Healthcare	4
7	CS 6307D	Computational Linear Algebra	4
8	CS 6308D	Computational Optimization Methods	4
9	CS 6309D	High Performance Computing for AI	4
10	CS 6310D	Intelligent Agents	4
11	CS 6311D	Approximation Algorithms	4
12	CS 6312D	Speech Information Processing	4

13	CS 6313D	Advanced Data Structures and Algorithms	4
14	CS 6314D	Internet of Things	4
15	CS 6315D	Data Mining	4
16	CS6316D	Data Modeling and Visualization	4
17	CS 6317D	Term Paper	4
18	CS 6171D	Natural Language Processing	4
19	CS 6151D	Software Engineering	4
20	CS 6154D	Topics in Database Design	4
21	CS 6133D	Game Theory	4
22	CS 6173D	Image Processing	4
23	CS 6181D	Bioinformatics	4
24	CS 6174D	Pattern Recognition	4
25	CS 6141D	Distributed Computing	4
26	CS 6201D	Cryptography	4
27	CS 6112D	Operating System Design	4
28	CS 6213D	Foundations of Information Security	4
29	CS 6132D	Topics in Algorithms	4
30	CS 6122D	Computer Architecture	4
31	CS 6283D	Computer Laws and Ethics	4

32	CS 6102D	Compiler Design	4
33	CS 6135D	Logic for Computer Science	4
34	CS 6101D	Mathematical Foundations of Computer Science	4
35	CS 6111D	Algorithms and Complexity	4
36	CS 6103D	Software Systems Laboratory	4
37	MA 6301	Real Analysis	4
38	MA 6302	Linear Algebra	4
39	MA 6322	Measure and Probability	3
40	MA 7303	Mathematical Statistics	4
41	MA 7357	Numerical Linear Algebra	3
42	MA 7365	Multivariable Calculus	3
43	MA 7372	Regression Analysis	3
44	MA 7371	Applied Statistical Inference	3

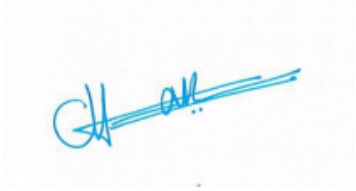


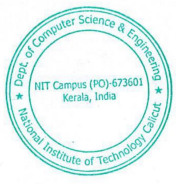
ANNEXURE 4

Comments from the members of the Department Advisory Board (DAB) and the Subsequent modifications done in the Proposed Curriculum

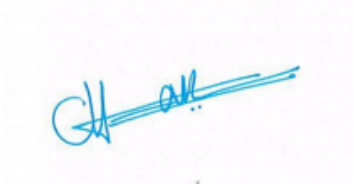
Abstract of the Comment	Revision incorporated for compliance
Mr. Jaganmohan Reddy Kancharla, Senior Development Manager, Informatica Business Solutions. Pvt. Ltd, Bangalore (Eminent Alumni). The curriculum looks good for me, **I would also suggest to include the below subjects.** **Advanced Data Structures and Algorithms** understanding of efficient software solutions for various applications areas using appropriately selected data structures and algorithms is also important for AI & DA. **Python for Machine Learning:** - There are various labs and not sure about the content, hands on programming exposure is also important mainly for the data visualization.	The course CS 6313D Advanced Data Structures and Algorithms has been included as an elective course. This course will fill the required background for students from non-CS backgrounds. Python will be introduced for solving problems in machine learning in the course CS 6393D Machine Learning Laboratory
Dr. Roshy John **Robotics and Cognitive Systems** **Tata Consultancy Services** The curriculum looks good, however, I don't find an application of cryptocurrency as a course for ML. Otherwise, everything seems good to me.	Applications to cryptocurrency will be included in the core course CS 6192D Machine Learning
Mr. Jayafar Moidu, Chief Executive Officer, JMR Infotech. (Eminent Alumni) and **Mr Manujith P Sasidharan, Director - Key Accounts, Financial Services BU, JMR InfoTech (Industry Expert)** 1. The field of AI/DA cuts across multiple disciplines and talented students from a broad range of disciplines might be interested in getting into a career in data science and AI. Therefore, the **eligibility to apply for this programme shall be made open to students from all disciplines of**	Eligibility has been modified as follows: Bachelor's degree of four years duration in any branch of Engineering/Technology OR Master's degree of two years duration in any stream of Science / Mathematics / Statistics / Computer Science / Computer Applications, from a recognized university / institute, with minimum 60% marks or CGPA of 6.5 (55% marks or CGPA of 6 for SC/ST candidates)

B.Tech. However, adequate evaluations may be carried out by the Institute to ensure quality of intake.	AND a valid GATE score in *Computer Science and Information Technology* OR *Electronics and Communication Engineering* OR *Electrical Engineering.*
2. The curriculum may be structured to cover the entire breadth of Data Science and AI including **Data Acquisition, Data Mining, Data Visualization, Predictive Analytics, Foundations of AI, Machine Learning techniques, Deep Learning** etc. Students may be allowed to delve into some of the business use cases as well. A **mandatory coverage of Deep Learning may be considered, as Deep Learning is lately occupying a larger space in the AI universe.**	The following core courses introduce the students to the broad spectrum of topics mentioned with practical components integrated into the course. CS 6301D Introduction to Data Analytics CS 6172D Artificial Intelligence
3. The course may also cover the **top AI/ML tools such as Python, R, MATLAB and various other packages/tools built by various organizations,** which have facilitated exponential growth of AI in recent times. We presume that this would be covered under the Artificial Intelligence Lab course mentioned in the proposal. 4. Swarm Intelligence is an area which is re-emerging and finding applications in Stock markets, Sales Forecasting, Optimization etc. It may be offered as an elective subject in the course. 5. If there is provision for M.Tech students to get industry exposure through working with Companies/Start-ups in AI space during the course itself, that would pre-equip them for the job. It could be as part of their project in later semesters or as short-term internship programmes.	The following elective courses are designed to allow the student to explore these topics further in depth, depending on his/her interest of specialization: CS 6155D Topics in Data Analytics CS 6316D Data Modeling and Visualization CS 6305D Neural Networks and Deep Learning CS 6304D Advanced Deep Learning and Computer Vision CS 6315D Data Mining CS 6393D Machine Learning Laboratory An elective course CS 6308D Computational Optimization Methods has been included. The course is designed to cover the topics mentioned. The existing institute regulations permit such interaction.





Dr. V. K. Govindan, Retired Professor, CSED, NITCalicut. I have gone through the proposal for the new MTech programme in AI & DA. **The proposal is timely, and much relevant for industry and research organizations.** There is ample scope for such talented students. The courses suggested are proper for the programme. I have some suggestions: 1. The course/ programme content may include thorough emphasis for machine learning, sparse techniques, optimization, neural network/deep learning, etc. 2. Consider/ Discuss change of specialization title to " machine learning and data analytics" or "AI and ML" or "Machine learning and data science". If you have already discussed the title issue thoroughly, you can go ahead as it is.	The following core courses CS 6192D Machine Learning and CS 6172D Artificial Intelligence and the following elective courses CS 6308D Computational Optimization Methods CS 6305D Neural Networks and Deep learning CS 6304D Advanced Deep Learning and Computer Vision will cover all the topics mentioned. The department discussed the matter thoroughly and decided not to change the proposed title.
Dr. M P Sebastian, Professor, Indian Institute of Management Kozhikode (Academic Expert) 1. The MCA program lost its relevance, both academically and industrially. Technically it is a PG program, but the courses are of UG level. It is not adding any value to the CSE department or to NITC. 2. The proposed MTech Program is currently very relevant both academically and industrially, and will add value not only to the CSE department but also to the entire institution. This is one of the most preferred programs in the current context, both nationally and internationally. My best wishes.	No revisions required as per the suggestions..
Dr. Jasine Babu, Assistant Professor, IIT Palakkad. (Eminent Alumni). Such a programme is likely to attract students from non-CS backgrounds, because of better job prospects that it offers them. However, If it is open to students from other backgrounds, they may need to do one or two foundational courses in CS (e.g., Design and Analysis of Algorithms), before earning an	An elective course CS 6313D Advanced Data Structures and Algorithms has been included. Students from non-CS background can credit this course in the first semester itself to meet the prerequisites.



M.Tech degree in CSE. I assume that the syllabus of the "Mathematical Foundations of Machine Learning" course will address this. This would be important to meet PEO1, PO4 and PO5. It may be good to make it explicit what is the potential pool of candidates expected.	The syllabus of CS 6191D Mathematical Foundations of Machine Learning will be designed to address PEO1, PO4 and PO5. Specified in the revised proposal that graduates in any branch of Engineering or post-graduates in any branch of Science with a valid Gate score in Computer Science and Information Technology / Electronics and Communication Engineering / Electrical Engineering are eligible for admission.
Dr. Deepak Rajendraprasad, Assistant Professor and Associate Dean (Academic), IIT Palakkad. (Academic Expert) I went through the proposal carefully. I think this is a very timely change. I'm confident that the new M.Tech program will help address the demand for AI and DS professionals in the country and abroad. Please consider this email as my approval for the proposal.	No revisions required as per the suggestions.

Comments and Suggestions from our distinguished alumni currently doing research in AI and Data Analytics

"Overall, I agree that this area is very topical and it's important to have a Masters level course in AI & Data Science. This will help prepare students well for research as well as industry."

Sriganesh Srihari Ph.D (NUS)
(Bio-Medical Data Scientist)
Advance Queensland Industry Research Fellow

QIMR Berghofer Medical Research Institute

Brisbane, Australia

https://au.linkedin.com/in/sriganeshms

Founder and CEO

GraphMed Analytics Freelance
Brisbane, Australia

https://sites.google.com/view/graphmedanalytics/home

"The future of work and life is going to be dominated by AI Technologies. Artificial Intelligence is already transforming numerous sectors such as Health Care, Finance, and Autonomous Vehicles to name a few. AI has also been shaping all our online experiences such as search, social networking and shopping for more than a decade now. AI is and will continue to be a key differentiator for universities, companies and nations aspiring to be global leaders. However, there is a dearth of professionals who are trained in this field and the current academic programmes in the country are not enough to meet the present and the future demand for AI specialists. Commencing a masters programme focusing on AI and Data Analytics is the most consequential decision that the Department of CSE at NITC can take at the moment, to establish itself as the best place to specialize in AI in the state of Kerala, and to be on par with other prestigious institutes for advanced studies in all of India and abroad."

Dr. Rose Catherine Kanjirathinkal
Research Scientist
Facebook AI, New York, USA.
http://in.linkedin.com/in/rosecatherinek
https://sites.google.com/site/rosecatherinek

ANNEXURE 5

PEOs and POs

1. Programme Educational Objectives (PEOs)

PEO1: The graduates shall have an in-depth knowledge in the fundamentals of Artificial Intelligence and Data Analytics with the ability and confidence to specialize in specific areas of individual interest.

PEO2: The graduates shall have the ability to solve problems and critically analyze solutions in the area of interest in AI and Data Analytics.

PEO3: The graduates shall have the skill set for using knowledge in AI and Data Analytics, for the benefit of society with sound ethical practices and a lifelong interest in contributing to knowledge in the field

2. Programme Outcomes (POs)

PO1: An ability to independently carry out research / investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area of Artificial Intelligence and Data Analytics. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Students should be able to identify appropriate mathematical, analytical or software tools and use them to solve problems in the area of AI and Data Analytics , by applying appropriate skill sets acquired in the area.

PO5: Students should have the ability to critically analyze solutions, proofs and programs in the field of AI and Data Analytics.

PO6: Students should have the ability to communicate ideas, based on ethical values, and remain aware of the social responsibilities in the profession.

ANNEXURE 6

Details of Faculty (related to the proposed program)

and their Publications

Names of Faculty Members

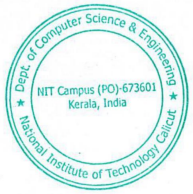
1. Dr. Abdul Nazeer K A
2. Dr. Anu Mary Chacko
3. Dr. Gopakumar G
4. Dr. Jayaraj P B
5. Dr. Jay Prakash
6. Dr. Lijiya A
7. Dr. Pournami P N
8. Dr. Pranesh Das
9. Dr. Saidalavi Kalady
10. Dr. Saleena N

Faculty Publications

Dr. K. A. Abdul Nazeer

Sl. No	Publication along with DOIs and publication/citation details
1	Jeena Kleenankandy, KA Abdul Nazeer, *Recognizing semantic relation in sentence pairs using Tree-RNNs and Typed dependencies,* 6th IEEE Congress on Information Science and Technology (CiSt), 2021, Pages:372-377 DOI: 10.1109/CiSt49399.2021.9357187.
2	KC Mahija, Stanzin Kadol, KA Abdul Nazeer, *Computational Investigation of Arjunarishta Formulation using Module-Network Analysis*, Advanced Computing and Communication Technologies for High Performance Applications,(ACCTHPA),2020,DOI:10.1109/ACCTHPA49271.2020.9213228

3	N. Nidheesh, K. A. Abdul Nazeer, P. M. Ameer, *A Hierarchical Clustering algorithm based on Silhouette Index for cancer subtype discovery from genomic data*, Springer, Cited by 1, 30 November 2019, DOI://doi.org/10.1007/s00521-019-04636-5
4	P Shamna, VK Govindan, KA Abdul Nazeer, *Content based medical image retrieval using topic and location model,* Journal of biomedical informatics, AcademicPress, Volume:91,Pages:103112,1 March 2019, DOI:https://doi.org/10.1016/j.jbi.2019.103112
5	EK Jasila, N Saleena, KA Abdul Nazeer, *Ontology Based Document Clustering-An Efficient Hybrid Approach,*IEEE 9th International Conference on Advanced Computing (IACC),13 December 2019,DOI: 10.1109/IACC48062.2019.8971594
6	R Visakh, KA Abdul Nazeer, *Multi-network approach to identify differentially methylated gene communities in cancer,* Gene,Elsevier,Cited by 1,Volume:697,20 May 2019, DOI:https://doi.org/10.1016/j.gene.2019.02.007
7	*Identifying synonyms in bigram phrases using Compositional DSM and Artificial Neural Network,*International Conference on Computing, Power and Communication Technologies (GUCON),27 September 2019, Pages:827-831.
8	Seelam Lavanya; K. A. Abdul Nazeer,*An Improved Computational Linguistic Approach for Fine-Grained Sentiment Analysis of Textual Reviews,* International Conference on Computing, Power and Communication Technologies(GUCON) 2018, DOI: 10.1109/GUCON.2018.8675021
9	KA Abdul Nazeer, *Part-of-speech Tagging and Named Entity Recognition Using Improved Hidden Markov Model and Bloom Filter,*International Conference on Computing, Power and Communication Technologies (GUCON),2018,DOI: 10.1109/GUCON.2018.8674901
10	P Shamna, VK Govindan, KA Abdul Nazeer, *Content-based medical image retrieval by spatial matching of visual words* ,Journal of King Saud University-Computer and Information Sciences, Elsevier, 11 October 2018, https://doi.org/10.1016/j.jksuci.2018.10.002



11	N Nidheesh, KA Abdul Nazeer, PM Ameer, *A hierarchical clustering algorithm based on silhouette index for cancer subtype discovery from omics data,* bioRxiv,Cold Spring Harbor Laboratory, Pages:309716, 1 January 2018, https://doi.org/10.1101/309716
12	R Visakh, KA Abdul Nazeer, *DEEPAligner: Deep encoding of pathways to align epigenetic signatures,*Computational Biology and Chemistry, Elsevier,Volume:72, Pages:87-95, 1 February 2018,https://doi.org/10.1016/j.compbiolchem.2018.01.002
13	Anu Balachandran; K.A. Abdul Nazeer, *An Improved Clustering Algorithm Based on k-Means and Artificial Bee Colony Optimization for Datasets that Contain Outliers,* International Conference on Computing, Power and Communication Technologies (GUCON), 2018,DOI :10.1109/GUCON.2018.8675121
14	N Nidheesh, KA Abdul Nazeer, PM Ameer, *An enhanced deterministic K-Means clustering algorithm for cancer subtype prediction from gene expression data,*Computers in Biology and Medicine, Volume 91, Pages 213-221, 2017, DOI:https://doi.org/10.1016/j.compbiomed.2017.10.014
15	MA Anitha, KA Abdul Nazeer, *Improved Parallel Clustering with Optimal Initial Centroids,* International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT), Pages:114-120, 10.1109/ICRAECT.2017.64
16	R. Visakh, KA Abdul Nazeer, *Identifying epigenetically dysregulated pathways from pathway–pathway interaction networks,* Computers in biology and medicine, Pergamon,Volume:76,Pages:160-167,https://doi.org/10.1016/j.compbiomed.2016.06.030
17	E. P. Sithara, K. A. Abdul Nazeer, *A Hybrid K Harmonic Means with ABC Clustering Algorithm using an Optimal K value for High Performance Clustering* ,International Journal on Cybernetics & Informatics, Volume:5, Issue:2

Anu Mary Chacko

Sl. No	Publication along with DOIs and publication/citation details
1	Sreenivasan M., Anu Mary Chacko, *Interoperability issues in EHR systems: Research directions,*Data Analytics in Biomedical Engineering and Healthcare, AcademicPress, Pages 13-28, Year 2021 https://doi.org/10.1016/B978-0-12-819314-3.00002-1
2	Ajay Chaudhary, Merlin George,Anu Mary Chacko,*Extractive Summarization of EHR Notes,* Proceedings of the International Conference on Paradigms of Computing, Communication and Data Sciences: PCCDS 2020, Springer Singapore, Pages:909-919, 2021
3	M. A. Sahla Habeeba, A. Lijiya, Anu Mary Chacko, *Detection of Deepfakes Using Visual Artifacts and Neural Network Classifier,* Innovations in Electrical and Electronic Engineering, Springer Singapore, Pages:411-422, DOI:https://doi.org/10.1007/978-981-15-4692-1_31
4	M. Sreeninvasan, Anu Mary Chacko, *A Case for Semantic Annotation Of EHR,* IEEE 44th Annual Computers, Software, and Applications Conference (COMPSAC),Pages:1363-1367,2020, 10.1109/COMPSAC48688.2020.00-66
5	Vimala Mathew, Tom Toby, Anu Chacko, A. Udhayakumar, *Person re-identification through face detection from videos using Deep Learning,*IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS),Pages:1-5, 16 December 2019, DOI: 10.1109/ANTS47819.2019.9117938
6	Merlin George, Anu Mary Chacko, Sudeep Koshy Kurien, Naseer Ali, *Diabetes care in cloud-research challenges,*Proceedings of the 34th ACM/SIGAPP Symposium on Applied Computing, Pages:160-162, 8 April 2019, DOI : https://doi.org/10.1145/3297280.3297537

7	Merlin George, Anu Chacko, Sudeep Koshy Kurien, *Proactive diabetes management: research directions,*Proceedings of the 20th International Conference on Distributed Computing and Networking,Pages:486-491, 4 January 2019, DOI :https://doi.org/10.1145/3288599.3297119
8	Vimala Mathew, Tom Toby, Anu Chacko, A. Udhayakumar, *Person re-identification through face detection from videos using Deep Learning,* IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS), Pages:1-5, 16 December 2019, DOI:10.1109/ANTS47819.2019.9117938
9	Vimala Mathew, Anu Mary Chacko, A. Udhayakumar, *Prediction of suitable human resource for replacement in skilled job positions using Supervised Machine Learning,* 8th International Symposium on Embedded Computing and System Design (ISED), Pages:37-41, 13 December 2018, DOI: 10.1109/ISED.2018.8704120
10	Raima Zachariah, K. Akash, Mohammed Sajmal Yousef, Anu Mary Chacko, *AdultSwine: A case study,* International Conference on Advances in Computing, Communications and Informatics (ICACCI), Pages:1345-1349, 19 September 2018, DOI: 10.1109/ICACCI.2018.8554732
11	Anu Mary Chacko, Jayendra Sreekar Medicherla, S. D. Madhu Kumar, *Anomaly Detection in MapReduce Using Transformation Provenance*, Advances in Big Data and Cloud Computing, Pages:91-99, Springer Singapore, 2018, DOI:https://doi.org/10.1007/978-981-10-7200-0_8
12	Raima Zachariah, K. Akash, Mohammed Sajmal Yousef, Anu Mary Chacko, *Android malware detection a survey* , IEEE international conference on circuits and systems (ICCS), Pages:238-244, 20 December 2017, DOI: 10.1109/ICCS1.2017.8325997
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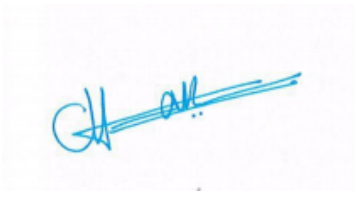

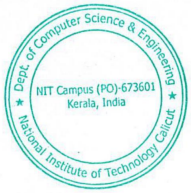

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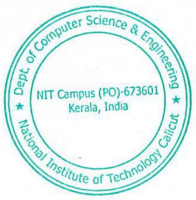
17	Anu Mary Chacko, Alfredo Cuzzocrea, S. D. Madhu Kumar, *Automatic Big Data Provenance Capture at Middleware Level in Advanced Big Data Frameworks,* Connected Environments for the Internet of Things, Pages:219-239, Springer, Cham, 2017, DOI:https://doi.org/10.1007/978-3-319-70102-8_11
18	Anu Mary Chacko, Munavar Fairooz, S. D. Madhu Kumar, *Provenance-aware NoSQL databases,* International Symposium on Security in Computing and Communication, Springer Singapore, Pages:152-160, 21 September 2016, DOI:https://doi.org/10.1007/978-981-10-2738-3_13

Dr. Gopakumar G.

Sl. No	**Publication along with DOIs and publication/citation details**



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2	Sunil Kumar, Adheeba Thahsin, M Manju, G. Gopakumar, *A Heterogeneous Information Network Model for Long Non-Coding RNA Function Prediction,* IEEE/ACM Transactions on Computational Biology and Bioinformatics, 8 June 2020, DOI: 10.1109/TCBB.2020.3000518
3	P. V. Sunil Kumar, G. Gopakumar, *Inferring disease and pathway associations of long non-coding RNAs using heterogeneous information network model,* Journal of bioinformatics and computational biology, Volume:17, Issue:04, Pages:1950020, World Scientific Publishing Company, 29 August 2019, DOI:https://doi.org/10.1142/S0219720019500203
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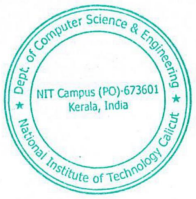
5	P. V. Sunil Kumar, G. Gopakumar, *Relrank: An Algorithm for Relevance-Based Ranking of Meta-Paths in a Heterogeneous Information Network,* IEEE Recent Advances in Intelligent Computational Systems (RAICS), 98-102, 6 December 2018, DOI: 10.1109/RAICS.2018.8635053
6	P. V. Sunil Kumar, M. Manju, G. Gopakumar, *Function prediction of cancer-related LncRNAs using heterogeneous information network model,* International Journal of Data Mining and Bioinformatics, Volume:21, Issue:4,Pages:315-338, Inderscience Publishers (IEL), 2018, DOI:https://doi.org/10.1504/IJDMB.2018.098940



7	C. M. Sreeshma, Madhavan Manu, G. GopaKumar, *Identification of Long Non-coding RNA from inherent features using Machine Learning Techniques,* International Conference on Bioinformatics and Systems Biology (BSB), 2018, DOI: 10.1109/BSB.2018.8770699
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9	PB Jayaraj, K Rahamathulla, G Gopakumar, *A GPU based maximum common subgraph algorithm for drug discovery applications,* IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), Pages:580-588, Publisher:IEEE, Cited by 2, 23 May 2016, DOI: 10.1109/IPDPSW.2016.65

Dr. Jay Prakash

Sl. No	**Publication along with DOIs and publication/citation details**
1	Jay Prakash, Pramod Kumar Singh, *Gravitational search algorithm and K-means for simultaneous feature selection and data clustering: a multi-objective approach,* Journal:Soft Computing, Volume:23, Issue:6, Pages:2083-2100, Publisher:Springer Berlin Heidelberg, Cited by 11, March 2019, DOI:https://doi.org/10.1007/s00500-017-2923-x0
2	J Prakash, PK Singh, *Hybrid Gbest-guided Artificial Bee Colony for hard partitional clustering,* International Journal of System Assurance Engineering and Management, Pages:1-18, Publisher:Springer India, Cited by 2, 2017, DOI:https://doi.org/10.1007/s13198-017-0684-7

3	Avadh Kishor, Pramod Kumar Singh, Jay Prakash, *NSABC: Non-dominated sorting based multi-objective artificial bee colony algorithm and its application in data clustering,* Journal:Neurocomputing, Volume:216, Pages:514-533, Publisher:Elsevier, Cited by 46, 5 December 2016, DOI: https://doi.org/10.1016/j.neucom.2016.08.003

Dr. Jayaraj P. B.

Sl. No	Publication along with DOIs and publication/citation details
1	P.B. Jayaraj, K.M. Mithun, G. Gopakumar, U.C.A. Jaleel, "A GPU based virtual screening tool using SOM." International Journal of Computational Biology and Drug Design 14.1 (2021): 64-80. Publisher: Inderscience, DOI:https://doi.org/10.1504/IJCBDD.2021.114098
2	Seenia Francis, Darshana Suresh, Shalini Nath, Saai Lakshmi D R, Jayaraj P B, Niyas Puzhakkal, and Pournami P N. ” Monte Carlo Simulation of Linear Accelerator for Dosimetry Analysis ”, IEEE Sponsored 6th International Conference for Convergence in Technology (I2CT) 2021”. IEEE Bombay section, Pune, April 2021 (In Press)
3	V. A. Jisna, AKil P, J Vinod Kumar Reddy, Pournami P. N. and P. B. Jayaraj, Towards Protein Tertiary Structure Prediction using LSTM/BLSTM, Fourth International Conference on Computing and Network Communications,CoCoNet 2020, Chennai, India, Oct 14-17 2020. [In Press]
4	Kumar Avinash, MB Bijoy, PB Jayaraj, *Early Detection of Breast Cancer Using Support Vector Machine With Sequential Minimal Optimization,* Book:Advanced Computing and Intelligent Engineering, Pages:13-24, Publisher:Springer, Singapore, 2020, DOI:https://doi.org/10.1007/978-981-15-1081-6_2

5	PB Jayaraj, Samyak Jain, *Ligand based virtual screening using SVM on GPU,* Journal:Computational biology and chemistry, Volume:83, Pages:107143, Publisher:Elsevier, Cited by 3, 1 December 2019, DOI: https://doi.org/10.1016/j.compbiolchem.2019.107143
6	Sharon Sunny, Deepesh Kataria, PB Jayaraj, *An Improved Protein-Protein Docking Technique Using Multilevel Scoring Function*, Conference:TENCON 2019-2019 IEEE Region 10 Conference (TENCON), Pages:751-756, Publisher:IEEE, Cited by 0, 17 October 2019, DOI: 10.1109/TENCON.2019.8929261
7	MB Bijoy, A Ansal Muhammed, PB Jayaraj, *Segmentation Based Preprocessing Techniques for Predicting the Cervix Type Using Neural Networks,* Conference:International Conference On Computational Vision and Bio Inspired Computing, Pages:717-726, Publisher:Springer, Cham, Cited by 0, 25 September 2019, DOI:https://doi.org/10.1007/978-3-030-37218-7_81
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10	MB Bijoy, Vaibhav Shilimkar, PB Jayaraj, Detecting Cervix Type Using Deep learning and GPU, Conference:2018 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Pages:1-6, Publisher:IEEE, Cited by:0, 6 December 2018, DOI: 10.1109/R10-HTC.2018.8629824

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Dr. Lijiya A.

Sl. No	Publication along with DOIs and publication/citation details
1	KC Shahira, A Lijiya, *Towards Assisting the Visually Impaired: A Review on Techniques for Decoding the Visual Data from Chart Images,* Source:IEEE Access, Publisher:IEEE, Cited by 0, 29 March 2021, DOI: 10.1109/ACCESS.2021.3069205
2	MA Sahla Habeeba, A Lijiya, Anu Mary Chacko, *Detection of Deepfakes Using Visual Artifacts and Neural Network Classifier,* Book:Innovations in Electrical and Electronic Engineering, Pages:411-422, Publisher:Springer, Singapore, Cited by:0, 2020, DOI:https://doi.org/10.1007/978-981-15-4692-1_31
3	Lijiya A and Sudheer AP Shah Rutvik Vrajesh, Amudhan. AN, S*huttlecock Detection and Fall Point Prediction using Neural Networks,* International Conference for Emerging Technology (INCET), Belgaum, India, 2020, Pages:1-6, Cited by 0, 2020, DOI: 10.1109/INCET49848.2020.9154136

4	PK Athira, CJ Sruthi, A Lijiya, *A Signer Independent Sign Language Recognition with Co-articulation Elimination from Live Videos: An Indian Scenario,* Journal:Journal of King Saud University-Computer and Information Sciences, Publisher:Elsevier, Cited by 10, 7 May 2019, DOI:https://doi.org/10.1016/j.jksuci.2019.05.002
5	CJ Sruthi, A Lijiya, *Signet: A Deep Learning based Indian Sign Language Recognition System,* Conference:2019 International Conference on Communication and Signal Processing (ICCSP), Pages:0596-0600, Publisher:IEEE, Cited by 7, 4 April 2019, DOI: 10.1109/ICCSP.2019.8698006
6	KC Shahira, Sagar Tripathy, A Lijiya, O*bstacle Detection, Depth Estimation And Warning System For Visually Impaired People,* TENCON 2019-2019 IEEE Region 10 Conference (TENCON), Pages:863-868, Publisher:IEEE, Cited by 2, 17 October 2019, DOI: 10.1109/TENCON.2019.8929334
7	S Sreena, A Lijiya, *Skin Lesion Analysis Towards Melanoma Detection*, 2nd International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Volume:1, Pages:32-36, Publisher:IEEE, Cited by 2, 5 July 2019, DOI: 10.1109/ICICICT46008.2019.8993219
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9	KC Shahira, A Lijiya, *Document Image Classification: Towards Assisting Visually Impaired,* TENCON 2019-2019 IEEE Region 10 Conference (TENCON), Pages|:852-857, Publisher:IEEE, Cited by 1, 17 October 2019, DOI: 10.1109/TENCON.2019.8929594

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Dr. Pournami P. N

Sl. No	Publication along with DOIs and publication/citation details
1	PN Maddaiah, PN Pournami, *Image Registration Using Single Swarm PSO with Refined Search Space Exploration,* International Conference on Pattern Recognition and Machine Intelligence, Pages:337-346, Publisher:Springer, Cham, Cited by 0, 17 December 2019, DOI:https://doi.org/10.1007/978-3-030-34869-4_37
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6	KM Subhash, PN Pournami, Paul K Joseph, *Characterizing EMG signals using aggregated CENSUS transform,* 2018 11th Biomedical Engineering International Conference (BMEiCON), Pages:1-4, Publisher:IEEE, Cited by 1, 21 November 2018, DOI:10.1109/BMEiCON.2018.8609929
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Dr. Pranesh Das

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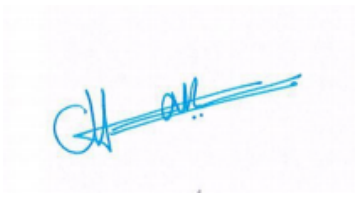

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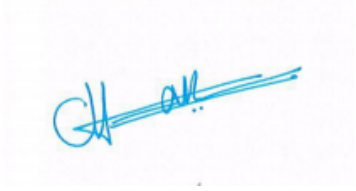

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ANNEXURE II

Proposal from CSED regarding IRG policies of the institute.

The following proposal is intended to provide motivation to individual departments to raise internal revenue by permitting the department the freedom to use a fraction of the revenue generated by the department for its own infrastructure development and support activities.

a) A head of account called **Department Development Fund (DDF)** may be initiated for each department where the IRG share for the department is accumulated.

b) The department share of the internal revenue generated may be credited to this head of account upon release of funds to the head by the institute and the *annual balance amount in the account may be rolled over to the next financial year*.

c) The department may be permitted to use the funds available in DDF for

1. Purchase of equipment or software or any other expenditure normally permitted under plan fund procurements.
2. Expenditure permissible under repair and maintenance expenditures, normally permitted under DOC.

d) Standard institute purchase and procurement procedures may be followed for expenditure from DDF.

e) The share of IRG credited to the DDF for revenue generated through fee payment for Part time/executive/Faculty Development Programmes/short term or other courses offered by a department other than regular programmes such as: B.Tech/M.Tech/Ph.D/MCA/MBA/MSc may be calculated as done for consultancy projects.

f) A share of the additional fee received through additional student intake via a) DASA admission b) Admissions offered in sponsored/self financed categories to any regular programme of the department may be treated as a contribution to IRG from the department and a share to the DDF may be calculated, as done for consultancy projects.

g) When collaborative partnership/joint consultancy work with external participants/institutions that may result in generation of revenue/intellectual property are initiated, the faculty/staff in the institute initiating the collaboration may propose to the Dean R&C and work out the institute share in the collaboration, depending on the work and the number and nature of collaborators. Based on the decision, a formal agreement may be initiated with the parties. *The policies of the division of the Institute share of the revenue between the institute, the department and the Individual(s), as well as the distribution of intellectual property rights may be clearly documented and made transparent in the agreement.* The steps in the procedures to be followed in initiating such collaborations and the format and order in which the documents are to be prepared may also be clearly documented by the institute in an Institute R&C Manual.

h) The institute may have a clear, transparent, documented policy regarding the distribution of the share of the IRG contributions to the institute, department and the consultant/principal investigator so that there is clear incentive for the parties to be engaged in more internal revenue generation activities. The provisions for expenditure admissible from the share of the individual as well as the department may also be documented for transparency.

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