INFORMATION BROCHURE

(FOR ADMISSION INTO M.Tech./M.Des./Ph.D.)

ADMISSION 2023-2024

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

(Deemed to be University, MoE, GoI)

www.cit.ac.in

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1 INTRODUCTION

1.1 ABOUT THE INSTITUTE

Central Institute of Technology Kokrajhar (CITK), is a 'Deemed to be University' under De-novo category vide Notification No. F.9-1/2016-U3 (A), dated December 13, 2018. It is administered under the Ministry of Human Resource Development (HRD), Government of India. It was established as an outcome of the Memorandum of Settlement (MoS) of Bodo Accord signed on February 10, 2003. The foundation stone of CIT Kokrajhar was laid on 10^{th} of February, 2003 by the then Honourbale Chief Minister of Assam, Sri Tarun Gogoi in presence of the then Honourable Deputy Prime minister of India Sri L. K. Advani. Consequently, CITK started its academic and administrative functions from December 06, 2006. The University is run by an autonomous body registered with the Societies Registration Act 1860 and functions under a Board of Governors (BoG).

1.2 ACADEMICS

CITK is presently offering Diploma, B.Tech., B.Des., M.Tech., M.Des. and Ph.D. programs in various disciplines. The core departments are - Electronics and Communication Engineering, Computer Science and Engineering, Instrumentation Engineering, Food Engineering and Technology, Civil Engineering and Multimedia Communication and Design.
Other departments include Basic Science (Mathematics, Physics and Chemistry), Allied Engineering Departments (Electrical and Mechanical Engineering) and Humanities and Social Science which comprises English, Economics and Sociology.
The estimated student strength of the Institute is about 1500+ and the Institute has more than 100 specialized faculty members from fields of Science, Engineering and Technology, Design and Humanities and Social Sciences.

1.3 MEMORANDUM OF UNDERSTANDING (MOU)

The Institute has signed MoU with various reputed academic institutes and Industries for extended collaboration in various educational and professional programmes. Some of the distinguished intuitions and industries are IIT Guwahati, Bodoland University Kokrajhar, Assam Science and Technology University (ASTU), UTP Malaysia, IOCL Bongaigaon, NTPC Salakati etc.

2 PROGRAMMES, DISCIPLINES/DEPARTMENTS AND INTAKE CAPACITY

Sl	Name of Programme	Name of Branches	Intake
1.	Master of Technology (M.Tech.)	Water Resources and Hydraulics Engineering	18
		Green Energy Technology.	18
		Food Engineering and Technology	18
		Civil Engineering	18
2.	Master of Design (M.Des.)	Multimedia Communication & Design.	15
3.	Doctor of Philosophy (Ph.D.)	Core Engineering Branches, Allied Engineering Branches, Basic Sciences, Humanities and Social Sciences, Multimedia Communication Design	*

* *the number of seats for Ph.D. depends on the availability of slot and relevance under supervising faculties.*

3 DETAILS OF DEPARTMENTAL RESEARCH AREAS-2023

The detailed list of specific research areas for Ph. D. Programme in the above mentioned department are-

Department	Research Areas
Electronics and Communication Engineering	Thin film technology for Electronics and Photonics applications. Device fabrication and characterization techniques. Polymer nanocomposite materials and applications. Micro and Nano-engineering technologies and applications for advanced electrochemical energy storage devices-Lithium-ion batteries, Supercapacitors. Advanced materials for Lithium-ion batteries and Supercapacitors for Bio-medical applications. New and cost-effective methods for generating nanomaterials for electrodes-Recycling and Reuse. Optoelectronic oscillator (OEO) and Photonics. Photonics in the transmission of mm. wave. Quantum Image Processing and Quantum Machine Learning. Semiconductor Devices. Synthesis of organic semiconductor based nanocomposite, Fabrication of Organic Field Effect Transistors as sensing device, Electronic Nose.

Computer Science & Engineering	Cyber Security, AI and Machine Learning, Human Computer Interaction, Architectural Design of Integrated Circuit, Natural Language Processing, Machine Learning Internet of Things, Wireless Sensor Networks, Soft Computing and Blockchain Technology.
Civil Engineering	Environmental Engineering, Geotechnical Engineering and Water Resources and Hydraulic Engineering
Food Engineering and Technology	Sustainable Food Preservation and Packaging. Edible and active films/coatings for food products. Thermal and Non-thermal Technologies to Extend Shelf Life of Fruits and Vegetables. Profiling nutritional and nutraceutical potential, & value addition of under-utilized crops. Novel, sustainable food preservation and processing Strategies. Phytochemicals and bioactive components, functional food, Value addition and nutrient enhancement.
Instrumentation Engineering	Instrumentation, Signal conditioning and processing, AI, Biomedical Instrumentation, Image Processing, Machine Learning, Robotics, Mechatronics, Semiconductor devices, Power Electronics, Modeling and Control of Dynamical Systems, Process Control, Energy Harvesting.
Physics	Ferroelectric and Multiferroic Material science and plasma physics Materials for magnetic storage
Chemistry	Inorganic synthesis, Porous material, MOF, catalysis Catalysis, porous material, organic reaction, waste material, and value-added chemicals Fermented food and beverages, natural products Computational chemistry/ Physical Chemistry
Mathematics	Plasma physics, Fluid Dynamics, Number Theory, Neutrosophic Sets and Fuzzy Logic, Topology and Mathematics Education
Humanities and Social Sciences	Agricultural Economics, Industrial Economics and Entrepreneurship
Multimedia Communication & Design	Visual Communication, Typography, 2D/3D Animation, Web Design, Interface Design, Interaction Design, Product Design, Branding, Design Research, Infographics, Animation & Multimedia, Visual Art, 3D Modelling Concept, Cartoon Concept Design, Typography Design, Graphics Design, Creativity & Design Innovation, Design research

4 ELIGIBILITY CRITERIA

The details of the eligibility criteria for admission to various M.Tech., M.Des. and Ph.D. programmes are given in this section. The same may be reviewed in the Senate meeting from time to time. Relaxation in academic qualification for candidates from reserved categories is as per Government of India guidelines.

4.1 Minimum qualifications for M.Tech. Programme

Minimum CGPA of 6.5 or 60% of marks or First Class in the qualifying degree, fulfilling specific requirements for different disciplines, are as indicated below:

Food Engineering & Technology: B.E./B.Tech. degree in Food technology/Food Engineering /Food Engineering & Technology/Food Technology & Biochemical Engineering /Agricultural & Food Engineering/Biotechnology or M.Sc. degree in Food Technology/Food Science and Technology/ Food Processing Technology/ Biotechnology for the specialization of Food Engineering & Technology or equivalent.

Water Resources & Hydraulic Engineering: B.E./B.Tech. Degree in Civil Engineering/Water resources/hydraulic Engineering or equivalent for the specialization.

Green Energy Technology: B.E./B.Tech. Degree in Electrical Engineering/Mechanical Engineering/Electronics Engineering/Instrumentation Engineering/Civil Engineering Chemical Engineering/ Food Engineering/Energy Engineering or equivalent.

Computer Science & Engineering: B.E./B.Tech. Degree in Computer Science & Engineering/M.Sc.(Computer Science/Information Technology) /Graduates (AMIETE) from Institution of Electronics and Telecommunication Engineers (IETE) in Computer Science & Engineering or MCA from a recognized Institution or equivalent and a valid (GATE) score.

4.2 Minimum qualifications for M.Des. Programme

Minimum CGPA of 6.0 or 55% of marks in the qualifying degree/diploma. Candidates who have completed three year degree programme (10+2+3 pattern) in any specialization from a recognized college or university with a minimum experience of one (1) year of professional programme/work experience in the relevant areas of art, animation, multimedia, mass media and design or passed four (4) year B.Des./BFA/BVA/Bachelors in Multimedia/Fashion/Accessory design or professional degree in BFA, BVA or equivalent.

4.3 Minimum qualifications for Ph.D. programme

The details of the eligibility criteria (i.e. minimum qualifications and experience) for admission to various Ph. D programs are given below. Relaxation in academic qualification for reserved categories of students is as per Government of India guidelines.

4.3.1 Ph.D. IN ENGINEERING

For admission to the Ph.D. Program in Engineering Departments, a candidate must satisfy one of the following criteria:
Master's degree in Engineering/Technology in a relevant area with a minimum CGPA of 6.5 or 60% of marks or
Bachelor's degree in Engineering/Technology in a relevant area with a minimum CGPA of 8.5 or 80% of marks or
A regular student of CIT Kokrajhar who is continuing his/her M. Tech studies and having a minimum CGPA of 8.0 at the end of second semester may be enrolled in the PhD Program of the Department in the beginning of his/her third semester of study. Such students can receive only Ph. D Degree. or
A student of CIT Kokrajhar who is continuing his/her B. Tech studies and having a minimum CGPA of 8.5 at the end of sixth semester may be enrolled in the Ph. D Program of the Department in the beginning of his/her seventh semester of study. Such students can receive dual B. Tech and PhD Degree. Both the degrees will be awarded after completion of PhD degree.

4.3.2 Ph.D. IN DESIGN

For admission to the Ph. D Program in Design, a candidate must satisfy one of the following criteria:
Candidates having M. Des/MFA/ MVA/M. Arch /M. Tech/ME degree in a relevant area, with a minimum CGPA of 6.5 or 60% of marks or
Master's degree in computer Applications/Geography/Rural development/social Sciences with a minimum CGPA of 6.5 or 60% marks or
Bachelor's degree in Design or Engineering/Technology in a relevant area with a minimum CGPA of 8.5 or 80% of marks or
A two-year Post-graduate Diploma in Design (NID/CEPT or equivalent) with first class at Bachelor's level or
BFA/BVA (4-year professional programme, after 10+2)/GD Art (5-year programme after 10th standard) with one year professional experience, with a minimum CGPA of 7.5 or 70% of marks or
A regular student of CIT Kokrajhar who is continuing his/her M. Des studies and having a minimum CGPA of 8.5 at the end of second semester may be enrolled in the Ph. D program of the Department in the beginning of his/her third semester of study. Such students can receive only Ph. D Degree or
A student of CIT Kokrajhar who is continuing his/her B. Des studies and having a minimum CGPA of 8.5 at the end of sixth semester may be enrolled in the Ph. D programme of the Department in the beginning of his/her seventh semester of study. Such students can receive dual B. Des and Ph. D Degree. Both the degrees will be awarded after completion of Ph. D degree.

4.3.3 Ph.D. IN SCIENCE

For admission to the Ph.D. Programme in Science departments, a candidate must satisfy one of the following criteria:
M.Sc / M.Phill degree in Science in a relevant area with a minimum CGPA of 6.5 or 60% of marks or
M.Tech degree in Engineering/Technology/Design in a relevant area with a minimum CGPA of 6.5 or 60% of marks or
Bachelor's degree in Engineering/Technology/Design in a relevant area with a minimum CGPA of 8.5 or 80%

4.3.4 Ph.D. IN HUMANITIES AND SOCIAL SCIENCES

For admission to the PhD Programme in the department of Humanities and Social Sciences (HSS), a candidate must satisfy one of the following criteria:
M.A / M. Phill Master's degree in Arts/Commerce/Science in a relevant area with a minimum CGPA of 6.0 or 55% marks or
Master's degree in Engineering/Technology/Design in a relevant area with a minimum CGPA of 6.5 or 60%marks. or
Bachelor's degree in Engineering / Technology / Design in a relevant area with a minimum CGPA of 8.5 or 80% marks

5 RESERVATION POLICY

Institute shall follow the scheme of special reservation policy as per the Memorandum of Settlement of Bodo Accord 2003.
However, in case the standing reservation policy fails to fill the intake capacity, the reservation policy of Govt. of India shall be referred.

6 ADMISSION PROCEDURE

6.1 M.Tech. Programme

The selection of aspiring candidates for admission in M. Tech. programme shall be through either the GATE score or the performance of candidates in CITKEE-2023 (Central Institute of Technology Kokrajhar Entrance Examination) conducted by CIT Kokrajhar. The candidates having a valid GATE may be given preference. However, the candidates must fulfil the eligibility criteria of essential Educational Qualifications. The GATE scores must be submitted along with the Application Form or at least 15 days before the declaration of the CITKEE-2023 Result.

6.2 M.Des. Programme

The selection of aspiring candidates for admission in M. Tech programme shall be through either the CEED score or the performance of candidates in CITKEE-2023 (for M.Des.) conducted by CIT Kokrajhar. The candidates having a valid CEED may be given preference. However, the candidates must fulfill the eligibility criteria of essential Educational Qualifications. The CEED scores must be submitted along with the Application Form or at least 15 days before the declaration of CITKEE-2023 Result.

6.3 Ph.D. Programme

The selection of candidates for admission into Ph.D. programme are made through a Written Test and Personal Interview conducted by CIT Kokrajhar.

7 CITKEE-2023

The CITKEE-2023 has been scheduled on 18^{th} June 2023 (Sunday) from 9:00 AM-12:00 Noon. CITKEE for M. Tech. will be of duration 3 hours consisting of 100 questions each carrying one (1) mark and CITKEE-2023 for M. Des will be for 3 hours with part-A having 40 MCQ type questions carrying 1 mark each and part-B having drawing and analytical type descriptive questions carrying a total of 60 marks. Total marks including Part-A and Part-B are 100. The schedule of the personal Interview will be notified during the day of declaration of the result on 11^{th} July, 2023. The detailed syllabus for CITKEE-2023 for M.Tech. and M.Des. are given in section 22.

8 WRITTEN TEST/PERSONAL INTERVIEW FOR Ph.D.

The Written Test for Ph.D. admission has been scheduled for 26^{th} June, 2023 (Sunday). The pattern of written test/personal interviews will be notified within due course of time. The detailed syllabus for Written Test for Ph.D. is given in section 20.

9 HOW TO APPLY

Candidates may fill out the application form through the online portal in: admission.cit.ac.in. The last date for applying for an admission is 15^{th} June, 2023. Candidates may keep a print copy of the online application form for their own reference.

10 COURSE DETAILS OF M.TECH./M.DES. PROGRAMME

10.1 M.Tech. Programme

10.1.1 Green Energy Technology

The master's programme in Green Energy Technology was started at the Central Institute of Technology Kokrajhar from the academic session 2019-20 keeping in view the need of the region and the relevance to the creation of high-level knowledge and skill in green energy or renewable energy sources. Green energy sources are non-polluting and non-depletion-type energy sources. Technologies related to these sources are very fast developing around the whole world. The programme is conducted by the Electrical Engineering Department and Mechanical Engineering Department with the help of several other departments like Civil Engineering, Food Engineering, Chemistry, Mathematics and Physics. The courses cover wide-ranging aspects of renewable energy sources like solar energy, wind energy, hydropower, and bio-energy for the development of sustainable infrastructure.

Programme Educational Objectives (PEOs)

The Programme Educational Objectives (PEOs) of this programme are to equip students with capabilities for identifying, formulating, analyzing, interpreting and providing solutions to problems and issues involving green energy sources.

Programme Outcomes (POs)

The Programme Outcomes (POs) of the Master's programme are that

i) the students would be able to execute the projects related to renewable energy sources,

ii) the students would be able to solve the problems related to renewable energy sources,

iii) the students would be able to demonstrate the impacts of renewable energy projects on society and the environment.

Scopes

The scope for students completing this Masters Programme would be

i) employment in government as well as private agencies, research establishments, etc. involved in developing, constructing, managing and providing consultancy in renewable energy

ii) employment in companies involved in developing green materials,

iii) undertaking further studies and research in all areas related to energy and

iv) entrepreneurship in areas related to renewable energy sources.

10.1.2 Water Resources and Hydraulic Engineering

Master's programme in Water Resources and Hydraulic Engineering was started at the Central Institute of Technology Kokrajhar in the academic session 2019-20. Keeping in view the need of the region and the relevance to the creation of high-level knowledge and skill in identified areas, this is one of the selected master programmes under Deemed to be University (Denovo Category) offered to the Institute. The programme is conducted by the Civil Engineering Department with courses covering wide-ranging aspects of water resources and hydraulic engineering including

interdisciplinary applications, the study of climate-change impacts, the study of water-energy-food nexus, assessment of risk and reliability of water for the future, development of sustainable infrastructure, development of decision support tools for physical resource management, etc. On successful earning of stipulated credit points on completion of classroom-based course-works in the first two semesters and project work in the next two semesters, a student would be awarded M.Tech. degree in Water Resources and Hydraulic Engineering.

Programme Educational Objectives (PEOs)

i) to equip students with capabilities for identifying, formulating, analyzing, interpreting and providing solutions to problems and issues involving water in various forms,

ii) to impart education and training to students so as to enable them to devise decision support systems of wide-ranging complexities for assessment, development and management of water resources, to undertake high-value research on water-related areas and to pursue lifelong learning,

iii) to give exposures to students on water-related problems, strategies and solutions at different international, national and regional settings, and

iv) to train students to conduct collaborative works and to undertake large-value projects for real-life problem solving involving water.

Programme Outcomes (POs)

- the graduates of the program would be able to demonstrate in-depth knowledge of the discipline and the capability to apply that knowledge in dealing with issues related to water,
- the graduates would be able to demonstrate the skill and competence in integrating concepts and strategies of solving problems related to water resources across multiple disciplines,
- the graduates would be able to demonstrate the ability to employ technical knowledge to water resources research and consultancy assignments,
- the graduates would be able to demonstrate the ability to carry out original and useful research in key areas of water resources and hydraulic engineering,
- the graduates would be able to demonstrate the ability to identify and analyze impacts of water resources development projects on society and environment and, likewise, the impacts of climate and extraneous factors on the availability and management of water resources,
- the graduates would be able to demonstrate confidence in water resource system analysis, alternative studies, and management of water resources with considerations of economics, ethics, safety, health and environment,
- the graduates would be able to demonstrate the enthusiasm and interest in pursuing lifelong learning for professional advancement,

- the graduates would be able to demonstrate the spirit of team-work for attaining common goals.

Scopes

- employment in government agencies and enterprises, private companies, research establishments, etc. involved in developing, constructing, managing and providing consultancy in water-infrastructure and built environments,
- employment in companies sourcing water for meeting various process-related needs,
- undertaking further studies and research in all areas related to water and
- entrepreneurship in areas related to the use and disposal of water for sustainable living

10.1.3 Food Engineering and Technology

Food processing is one of the sunrise sectors in our country. To meet the growing demands of processed / partially processed foods, processing industries are striving for technical personnel. The Department of Food Engineering and Technology at CIT Kokrajhar started Diploma in Food Processing Technology from the academic session 2006-'07, and B. Tech. Degree program in Food Engineering and Technology from the academic session 2009- '10. The M. Tech programme was started from 2019-20 session.

Programme Educational Objectives (PEOs)

- To analyze technological problems and judge independently to create information for conducting research in the area of Food Engineering & Technology
- To equip the students with state of art knowledge in the field of Food Engineering &Technology to prepare the students as leaders in the domain of industry, academia and research organization.
- To acquaint and equip students with professional, intellectual integrity and ethics of research for the sustainable development of society
- To enable the students individually to get engaged in lifelong learning and become capable to start-up their own business as entrepreneur.

Programme Outcomes (POs)

- Aptitude to design solutions for engineering problems with consideration for society and environment
- Ability to utilize research methods and synthesis of information to provide conclusions to multifaceted problems

- Aptitude to apply reasoning to assess societal issues and consequent responsibilities relevant to professional engineering practice
- Ability to understand the effect of engineering solutions on the environment and demonstrate the need for sustainable development
- Aptitude to engage in life-long learning due to fast technological change.

Scopes

- Highly qualified Food Engineers and Technologists are competent enough to take the responsibilities in the area of food product development.
- Competent Food Scientists and Technologists are capable to undergo research to improve existing methods of food processing, preservation and packaging. This also includes studying the food's nutritional content and investigating alternative sources of food and ways to purify foods containing additives.
- As a head of quality control division the highly qualified Food Engineers and Technologists are responsible for conducting testing procedures during manufacturing processes to ensure that products comply with quality standards.
- They are responsible for planning and organizing production schedules. They assess project and resource requirements, negotiate estimate, and approve budgets and timescales with clients and managers.

10.1.4 Computer Science and Engineering

The Department of Computer Science and Engineering of Central Institute of Technology, Kokrajhar is ready to prepare well qualified, motivated, application oriented young and dynamic students. At present the department is offering Diploma (3 years), B.Tech.(4 years), M.Tech.(2 years), and Ph.D. programmes. The two-year M.Tech. programme in Computer Science and Engineering has a comprehensive curriculum covering all areas in core and advanced topics with an emphasis on emerging technologies.

Programme Educational Objectives (PEOs)

- To equip the students with state of art knowledge in the field of computer science and Engineering
- To enable the students individually to solve problems and critically analyze solutions in the area of interest in Computing
- To acquaint and equip students with the skillset for using knowledge in Computing for the benefit of society with sound ethical practices

Programme Outcomes (POs)

- An understanding of the in-depth knowledge of recent computing technologies, skills and tools.
- An ability to find, read and understand published literature, and identify challenging issues in areas of interest in Computing
- An ability to carry out research in the specialized as well as emerging areas.
- An ability to understand the impact of computer science and engineering related solutions in an economic, societal and environment context
- An ability to understand the professional and ethical responsibility in the field of computer science and engineering.
- An ability to undertake original research in the different areas of computer science & engineering

Scopes
The course is designed to cover all aspects of Computer Hardware and Software with an emphasis on practical learning.
The course opens the following opportunities and job profiles:

- A professional career in the technology of software
- An academic career for further study and research at the cutting edge of computer science & its related areas

10.2 M. Des. Programme

10.2.1 Multimedia Communication & Design

Master of Design programme offered by the Department of Multimedia Communication and Design at CIT Kokrajhar has been initiated as part of the De-novo category specialization introduced at the institute from 2019. This master degree programme offers specialization in "Multimedia Communication and Design". It is a two (2) year, four (4) semester programme that consist of specially designed courses along with projects. The master degree programme in design has been considered equivalent to M.Tech. programme of engineering discipline.
Programme details
M.Des. in Multimedia Communication and Design: This programme specialization used to offer courses in the area of multimedia, visual communication, animation, visual effects, digital design etc.
Programme Educational Objectives (PEOs)
The M. Des. Programme in Multimedia Communication and Design is meant to develop Knowledge, Skills, Abilities and Aptitude among students to become creative problem solvers and to bring about innovative ideas in the area of communication design, multimedia and

the entertainment industry. It is a 2 year / 4 semester programme and has been considered equivalent to M.Tech. programme in engineering.
The syllabus has been aimed to offer specialized subjects and knowledge in the field of Multimedia Communication design that addresses a holistic approach towards industry, academics, research and entrepreneurship.

Programme Outcomes (POs)

The Programme outcome of M. Des. is meant to develop research abilities, innovative ideations and creative professionalism among students to become successful in their future endeavours. The students have been encouraged to take part in professional or industrial projects to get a hands-on experience to develop their creative abilities as well as to understand professionalism to deal with creative projects.

Scopes

A student can go for a career in design firms, entertainment industry, movie industry, animation industry, advertising, gaming industry, software firms etc. as a designer in multimedia and communication design domain. They also can have a career in academics by joining design institutes as faculty or instructor or opt for Ph.D. to further explore research in the design field.

11 DECLARATION OF RESULT

The Results of the CITKEE-2023 for PG and Ph.D. Written Test is scheduled to be declared on 11^{th} July, 2023 and 18^{th} July, 2023 respectively. However, the Institute reserves the right to postpone the scheduled date.

12 COUNSELLING AND ADMISSION

The counselling and admission for Masters programme is scheduled to be conducted on 25^{th} -26^{th} July 2023 at CIT, Kokrajhar.
Candidates selected for admission must get themselves admitted by payment of the fees on the date of counseling failing which their selection shall automatically be treated as cancelled.
Discrepancies found in the information furnished in the counselling form and in the application form may result in the cancellation of admission.
The presence of the candidate is compulsory during counselling. Under exceptional cases, a parent/guardian may be permitted on behalf of the candidate.
Candidates called for counselling do not guarantee a seat. Admission depends on the fulfilment of eligibility and availability of seats.
The candidates should not forget to bring the original and photocopies of all the relevant certificates during the day of counselling.
At the time of counselling and admission the selected candidates must provide the following certificates:

1. Age proof certificate
2. Mark sheet of HSLC or equivalent
3. Mark Sheets of 10+2 or equivalent.
4. Mark Sheets of relevant Degree courses of all semesters
5. Permanent Residential Certificate (PRC)
6. Caste Certificate (in case of SC/ST/OBC)
7. Person with disabilities (PWD) Certificate (if applicable)
8. Gap Certificate (if applicable)

The certificates listed from 1 to 8 are compulsory for counselling for confirming admission to CIT, Kokrajhar.

13 ANTI-RAGGING

Ragging in any form is banned in CIT and any one indulging in ragging during the entire period of his/her study in CIT is likely to be punished appropriately which may include expulsion from the Institute, suspension from the Institute or classes for a limited period, or fined with a public apology. The punishment may also take the shape of:

- Withholding Results
- Withholding Scholarships or other benefits
- Suspension or expulsion from the Hostel or Mess or Collective Punishment if the individual committing or abetting ragging is not identified, and/or an entry in the conduct certificate mentioning the act of ragging indulged in by the students concerned.

Admitted students shall have to submit an affidavit on a non-judicial stamp paper duly notarized by the Oath Commissioner by the student and the parent/guardian separately in a format that is available in the website http://www.antiragging.in/Site/Affidavits_Registration.aspx within fifteen days from the date of admission otherwise the admission stands cancelled. Further all the students admitted into the hostels have to submit a separate affidavit provided in CIT admission website.

14 FEE STRUCTURE FOR ADMISSION

The fee structure for admission into various programmes of the institute for the current academic year is available in the Institute's website and is summarized as follows:

Programme	Category	Admission Fee(INR)	Hostel Admission Fee(INR)	Mess Fee (for ONE semester)(INR)
M.TECH./ M.DES.	GE/OBC	28000	8500	12500
	SC/ST/PWD	20000	8500	12500
Ph.D.	GE/OBC	21500	11000	12500
	SC/ST/PWD	19000	11000	12500

N.B.: The Institute reserves the right to review the fee structure from time to time. The detailed breakup of fees structure can be obtained from the Institute's website.

15 ADMISSION WITHDRAWAL RULE

Withdrawal of Admission is allowed till 30 days from the date of admission. Candidates can withdraw his/her admission from the Institute by submitting an application form available in the CIT admission website. Refund of Fees after deducting processing fees would be done within this date. No request for refund of fees would be entertained after this period. The details of documents to be submitted along with withdrawal application form is given is admission web portal.

16 ATTENDANCE IN CLASS AFTER ADMISSION

Attendance on the first day of class of the semester is compulsory. Absence from class without proper intimation during the first 15 days would be treated as withdrawal of admission and such a student would not be allowed to join the classes.

17 APPLICATION FEES

Candidates applying for admission have to pay Rs.1500/-(rupees one thousands five hundred only) for GEN/OBC and Rs.750/-(rupees seven hundred fifty only) for SC/ST/PWD candidates. The application fees is not refundable.

18 GENERAL ACADEMIC REGULATIONS

18.1 GENERAL CONDUCT & DISCIPLINE

All students must conduct themselves as responsible people (as ladies & gentlemen). Students are not allowed to:

- Willfully damage or steal or remove property/belongings of the Institute/Hostel or fellow students
- Indulge in possession, consumption or distribution of alcoholic drinks and drugs.
- Take part in noisy and unseemly behavior and disturb the studies of fellow students.
- Resort to ragging fresher/fellow students.
- Take recourse to unfair means in examinations.
- Use Mobile Phones/I-Phones etc. in the academic buildings, library, laboratories & workshops.

18.2 LEAVE OF ABSENCE

All leave applications have to be submitted to the concerned Course Coordinators/HoDs stating fully the reasons and supported with documents. Leave of absence will be accepted only within a week of the student's rejoining of classes after ailments or other granted leaves. If a student will be away from the Institute for more than one week then prior application has to be submitted to the Dean of Student Affairs through the concerned HoD and such leaves will have to be sanctioned in advance. If a student is absent from the Institute for more than 06 (six) weeks without permission then that will result in his/her name being struck off from the Institute's Rolls. Under no circumstances should a student's attendance fall below 65%. In other words no consideration in attendance will be made once a student's attendance falls below 65% in a subject.

18.3 RENEWAL REGISTRATION FOR CONTINUING STUDENTS

A student has to register for continuation of study every Semester. A Renewal registration is considered only when the candidate submits the forwarding approval from the Departmental HoDs/Supervisors.

19 HOSTEL ADMISSION AND GENERAL HOSTEL RULES

For hostel Admission, the candidate has to apply separately in the Application Form, issued on the day of counseling and submit it to the Member Secretary, Hostel Committee. The

selected list will be finalized by 'Hostel Admission Committee' and approved by 'The Head of Institution'. All the admitted candidates to the hostels have to furnish an undertaking of not resorting to ragging in the hostels and the Institute. A student must remember that the hostel is the home of the students in the Campus and so is expected to behave in such a manner as to bring credit to oneself and to the Institution. The following rules have to be followed by all students residing in the hostels. Violation of hostel rules will make students liable for disciplinary actions including expulsion from the hostel.

Each student must occupy the room allotted to him/her for the session by the warden and no change of room shall be made without his/her permission.

No student shall keep any unauthorized person in his/her room.

In the event of mischief/foul play or accident etc. the warden can break open the room for investigation.

Whenever the student proposes to leave station or to remain outside the hostel for the night, he/she should obtain prior permission of the warden.

No female visitor is allowed to enter the boys' hostel and male visitor in girls' hostel without the written permission of the respective warden.

Students are forbidden to utilize the hostel staffs as privates or abuse them in any way.

Electric stoves, room heaters or other electric appliances are not allowed in the hostel.

19.1 Strictly forbidden in the hostel are

- *Possession or use of alcoholic beverages.
- *Possession or use of addictive or hallucinogenic drugs.
- *Possession or use of firearms/explosives or any lethal weapons.
- *Gambling
- *Playing cards
- *Loitering around unnecessarily.

Ragging in any form is strictly prohibited in the hostel room and compound. Ragging is a symbol of immaturity. To eliminate such incidents students of the first year are urged not to visit other hostels without the Warden's permission.

Cleanliness of the rooms is to be maintained by the student himself.

Hostel students are not allowed to use motorized vehicles inside the Campus.

Students should carry their Identity Card all the time and to produce the same whenever demanded by the authority.

Parents are especially requested to guide their ward so that their ward doesn't indulge in any physical violence.

Any point/issue not covered by these rules shall be decided by the Director.

All the students admitted into the hostels have to submit an affidavit provided in CIT admission website within one month from the date of hostel admission.

20 SYLLABUS OF CITKEE-2023

20.1 MASTER OF TECHNOLOGY

20.1.1 Green Energy Technology

(General Aptitude in Energy -40 Marks, Mathematics -20 Marks, Mechanical Engineering - 20 Marks, Electrical Engineering - 20 Marks)

Section 1 : Energy and Environment: Origin of the earth; Earth's temperature and atmosphere; Sun as the source of energy; Biological processes; photosynthesis; food chains; Energy sources: classification of energy sources, quality and concentration of energy sources; Overview of world energy scenario; Fossil fuel reserves - estimates, duration, overview of India's energy scenario, energy and development linkage. Ecological principles of nature, concept of ecosystems; different types of ecosystems; ecosystem theories; energy flow in the ecosystems; biodiversity. Environmental effects of energy extraction, conversion and use; Sources of pollution; primary and secondary pollutants; Consequence of pollution growth; Air, water, soil, thermal, noise pollution- cause and effect; Causes of global, regional and local climate change; Pollution control methods; Environmental laws on pollution control. Global warming; Green House Gas emissions, impacts, mitigation; Sustainability; Externalities, Future energy systems; clean energy technologies; United Nations Framework Convention on Climate Change (UNFCC); Sustainable development; Kyoto Protocol; Conference of Parties (COP); Clean Development Mechanism (CDM); Prototype Carbon Fund (PCF).

Section 2: Engineering Mathematics: Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors. Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems. Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations. Complex variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series. Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions. Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Section 3: Applied Mechanics and Design Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions. Mechanics of Materials: Stress and strain, elastic constants, Poisson's

ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength. Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

Section 4: Thermal Sciences: Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis. Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations. Applications: Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Section 5: Electric Circuits : Series & parallel circuit, Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Passive filters, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Two-port networks, Three phase circuits, Power and power factor in ac circuits, instruments.

Section 6: Electromagnetic Fields: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot- Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

Section 7: Electrical Machines: Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformers: connections, parallel operation; Auto-transformer, Electromechanical energy conversion principles, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Operating principle of

single phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.

20.1.2 Water Resources and Hydraulics Energy

Section 1: General Aptitude

Verbal ability: English grammar, Sentence completion, Verbal analogies, Word Groups, Instructions, Critical reasoning and Verbal deduction;

Numerical ability: Numerical computation, Numerical Estimation, Numerical reasoning and data interpretation, pattern recognition.

Section 2: Engineering Mathematics Linear Algebra: Matrix algebra; Systems of linear equations;

Calculus: Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima, application of definite integral to obtain area and volume; Partial derivatives; Total derivative; Gradient, Divergence and Curl,.

Ordinary Differential Equation (ODE): First order (linear and non-linear) equations; higher order linear equations with constant coefficients.

Partial Differential Equation (PDE): Fourier series; separation of variables; solutions of one-dimensional diffusion equation; first and second order one-dimensional wave equation.

Probability and Statistics: Definitions of probability and sampling theorems; Conditional probability; Discrete Random variables: Poisson and Binomial distributions; Continuous random variables: normal and exponential distributions; Descriptive statistics - Mean, median, mode and standard deviation; Hypothesis testing.

Numerical Methods: Accuracy and precision; error analysis. Numerical solutions of linear and non-linear algebraic equations; Least square approximation, numerical differentiation, Integration by trapezoidal and Simpson's rule, single and multi-step methods for first order differential equations.

Section 3: Structural Engineering

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; flexural and shear stresses. Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses; Displacement methods: Slope deflection and moment distribution methods. Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, short term and long-term properties; Bricks and mortar; Timber; Bitumen. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM. Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length. Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam-columns, column bases; Connections - simple and eccentric, beam-column connections.

Section 4: Geotechnical Engineering

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One-dimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Section 5: Water Resources Engineering

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow

Hydrology: Hydrologic cycle, precipitation, evaporation, evapotranspiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's law.

Irrigation: Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Section 6: Environmental Engineering

Water and Waste Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).
Section 7: Transportation Engineering
Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments. Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements.
Section 8: Geomatics Engineering
Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.

20.1.3 Food Engineering and Technology

Section 1: Food Chemistry and Nutrition Water& Water Activity: water in food, bound moisture, unbound moisture, free moisture, equilibrium moisture content, the water activity of microorganisms, water activity and shelf stability of food products Carbohydrates: structure and functional properties of mono, di, oligo and poly - saccharides including starch, cellulose, pectic substances and dietary fibre, gelatinization and retrogradation of starch. Proteins: classification and structure of proteins in food, Physico chemical and functional properties of amino acids Lipids: classification and structure of lipids, rancidity, reversion, interesterification, polymorphism. Pigments: carotenoids, chlorophylls, anthocyanins, tannins and myoglobin. Food flavours: terpenes, esters, aldehydes, ketones and quinines. Enzymes: specificity, simple and inhibition kinetics, coenzymes, enzymatic and non- enzymatic browning, enzymes in food processing Nutrition: balanced diet, essential amino acids and essential fatty acids, protein efficiency ratio, water soluble and fat soluble vitamins, role of minerals in nutrition, co -factors, anti -nutrients, nutraceuticals, nutrient deficiency diseases.
bf Section 2: Food Microbiology Characteristics of microorganisms: morphology of bacteria, yeast, mold and actinomycetes, spores and vegetative cells, simple and gram staining. Microbial growth: Factors influencing microbial growth, bacterial growth curve, generation time, culture doubling time, microbial growth and death kinetics, serial dilution technique. Food Microbiology: spoilage microorganisms in different food products including milk, fish, meat, egg,fruits and vegetables, cereals and their products, genetically modified foods, food borne diseases Fermented foods and beverages: curd, yoghurt, cheese, pickles, soya-sauce, sauerkraut, idli, dosa, vinegar, alcoholic beverages and sausage.
Section 3: Food Products Technology Food Preservation Technologies: thermal processing, chilling, freezing, dehydration, addition of preservatives and food additives, irradiation, fermentation, hurdle technology, intermediate moisture foods. Food packaging and storage: Packaging materials, aseptic packaging, vacuum packaging, and retortable packaging controlled and modified atmosphere storage. Cereal processing and products: milling of rice, wheat, and maize, parboiling of paddy, bread, biscuits, extruded products and ready to eat breakfast

cereals.
Fruits and vegetables processing: extraction, clarification, concentration and packaging of fruit juice, jam, jelly, marmalade, squash, candies, tomato sauce, ketchup, and puree, potato chips, pickles . Plantation crops processing and products: tea, coffee, cocoa, spice, extraction of essential oils and oleoresins from spices. Milk and milk products processing: pasteurization and sterilization, cream, butter, ghee, ice- cream, cheese and milk powder. Fish, meat and Poultry processing:Curing,smoking,drying, canning, and freezing of fish and meat; Fish products and by products, meat sausage, meat analogues, biochemical changes in post mortem a n d tenderization of muscles, Poultry processing technology, production of egg powder. Waste management: BOD, COD, biological waste treatment techniques, solid waste management Food standards and quality maintenance: FPO, PFA, Agmark, ISI, HACCP, food plant sanitation and cleaning in place (CIP).
Section 4: Food Process Engineering Fundamentals of Food Engineering: Material and energy balance, Momentum transfer, flow of fluids and, Reynolds number, viscosity, Newtonian and Non Newtonian fluids Heat transfer: heat transfer by conduction, convection, radiation, heat exchangers Mass transfer: molecular diffusion and Fick's law, conduction and convective mass transfer, permeability through single and multilayer films. Mechanical operations: size reduction of solids, high pressure homogenization, filtration, centrifugation, settling, sieving, mixing & agitation of liquid. Thermal operations: thermal processing and process time evaluation, evaporation of liquid foods, drying kinetics, drying equipments, spray and freeze-drying, freezing and crystallization. Humidification: General theory, psychometric chart, fundamental concept of humidification and dehumidification, cooling tower.

20.1.4 Computer Science and Engineering

Section-1: Engineering Mathematics:
Discrete Mathematics: Propositional and first first-orde. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring.
Combinatorics: counting, recurrence relations, generating functions.
Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition.
Calculus: Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.
Probability: Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.
Section 2: Digital Logic
Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).
Section 3: Computer Organization and Architecture
Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface

(interrupt and DMA mode).

Section 4: Programming and Data Structures

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Section 5: Algorithms

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.

Section 6: Theory of Computation

Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability.

Section 7: Compiler Design

Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Section 8: Operating System

Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

Section 9: Databases

ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Section 10: Computer Networks

Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

20.2 MASTER OF DESIGN

The syllabus consist of three parts: Part A, Part B and Part C.

PART – A MCQ / Objective type / Short descriptive type

Section 1: LOGICAL QUESTION TYPE: Questions will be asked on different type of logical/puzzle based/match making based subjects. These may be objective type, very short descriptive type, single answer type and multiple choice type in nature.

Section 2: ANALYTICAL QUESTION TYPE: Questions will be asked on brief analysis type such as solving a particular problem, proposing a solution to a problem with brief analysis. These may be objective type, very short descriptive type, single answer type and multiple choice type in nature.

Section 3: CREATIVE ABILITY TYPE: Questions will be asked on various areas of creative involvement. E.g., famous logo design, art &craft, famous creative personality, movies,

design/art history, famous products etc. These may be objective type, very short descriptive type, single answer type and multiple choice type in nature. # Total number of questions in this section will be 40. Ten (10) questions each for section 1 & 2 and 20 questions for section 3. Marks to be allocated in PART – A will be a total of 40 with 1 marks for each question.

PART – B

Section 1: PROBLEM SOLVING AND ANALYSIS: This section covers the area following quality of a candidate – (i) Visual perception and design sensitivity (ii) Illustration and visualization (iii) Problem identification and analysis (iv) Observation and design approach # Total number of questions will be two (2) comprises of 15 marks each. A total of 30 marks has been allotted to this section. # Questions will be asked to design / present /conceptualize new ideas / products / solutions for a particular set of requirements / problems / need etc. Candidates need to attempt the questions with above mentioned approach.

Section 2: SKILL BASED EVALUATION: This section covers the area following skills of a candidate – (i) Drawing and illustration skills (ii) Presentation skills (iii) Colour sense and(iv) Visualization skills # Total number of questions will be two (3) comprises of 15 marks each. A total of 30 marks has been allotted to this section. # Questions will be asked to draw / illustrate / make copy of a particular sketch given or may be to compose a conceptual scenario in illustration. Candidates need to attempt the questions with above mentioned approach.

PART – C This section comprises of a personal interview where candidate will have to present their personal portfolio, professional experience, extra-curricular activity and any contribution towards creative fields. # This section carries a total marks of 100 which will be distributed equally based on the above mentioned points.

IMPORTANT NOTE:

A total of 200 marks has been allotted to the entire selection process of Master of Design (M.Des.) programme offered by the Department of Multimedia Communication and Design at Central Institute of Technology Kokrajhar as mentioned in the above sections. Out of 200 marks, 100 marks will be for written part and rest 100 marks will be for interview part.

20.3 DOCTOR OF PHILOSOPHY

20.3.1 Research Methodology (Common paper) *(Weightage 50%)*

Unit-1: Basic concepts on research Identification of research problem Rationale of research, Research Objectives, Types of research fundamental/appled/action/quantitative/qualitative, Research design,

Unit-2: Review of literatures Primary source, Secondary source, E-resources ad search engines, Searching data base, writing literature review.

Unit-3: Methods of research Concepts of formulation of hypothesis, Survey method and / or Experimental method (variable, designs), Historical methods, Content Analysis

Unit-4: Sampling of data Concepts of sampling, Probability sampling techniques, Non-probability sampling techniques, sampling error.

Unit-5: Collection data Primary data generation, Secondary data generation, Method of data generation/collection – experiments, questionnaire, interview schedule, focus groups etc.
Unit-6: Data Analysis Statistical Analysis technique, Qualitative analysis technique, Application of computer in research and data analysis.
Unit-7: Preparation of Research Report Structure and component of research report, Organization of data, indexing of Journal and Research output, Citation, References, bibliography, Copyright, plagiarism, originality of research work
Unit-8: Research Ethics Ethics in research, National and International regulations/laws/ethics related to research on human, animals and environment.

20.3.2 Core Subjects *(Weightage 50%)*

20.3.2.1 Department of Instrumentation Engineering

Unit 1: Electrical Circuits Voltage and current sources: independent, dependent, ideal and practical; v-i relationships of resistor, inductor, mutual inductance and capacitor; transient analysis of RLC circuits with dc excitation.
Kirchhoff's laws, mesh and nodal analysis, superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems. Peak-, average- and rms values of ac quantities; apparent-, active- and reactive powers; phasor analysis, impedance and admittance; series and parallel resonance, locus diagrams, realization of basic filters with R, L and C elements. transient analysis of RLC circuits with ac excitation
Unit 2: Signals and Systems Periodic, aperiodic and impulse signals; Laplace, Fourier and z-transforms; transfer function, frequency response of first and second-order linear time-invariant systems, impulse response of systems; convolution, correlation. Discrete-time system: impulse response, frequency response, pulse transfer function; DFT and FFT; basics of IIR and FIR filters.
Unit 3: Control Systems Feedback principles, signal flow graphs, transient response, steady-state-errors, Bode plot, phase and gain margins, Routh and Nyquist criteria, root loci, design of lead, lag and lead-lag compensators, state-space representation of systems; time-delay systems; mechanical, hydraulic and pneumatic system components, synchro pair, servo and stepper motors, servo valves; on-off, P, PI, PID, cascade, feed forward, and ratio controllers, tuning of PID controllers and sizing of control valves.
Unit 4: Analog Electronics Characteristics and applications of diode, Zener diode, BJT and MOSFET; small- signal analysis of transistor circuits, feedback amplifiers. Characteristics of ideal and practical operational amplifiers; applications of opamps: adder, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier, precision rectifier, active filters, oscillators, signal generators, voltage- controlled oscillators and phase-locked loop, sources and effects of noise and interference in electronic circuits.
Unit 5: Digital Electronics Combinational logic circuits, minimization of Boolean functions. IC families: TTL and CMOS. Arithmetic circuits, comparators, Schmitt trigger, multi-

vibrators, sequential circuits, flipflops, shift registers, timers and counters; sample-and-hold circuit, multiplexer, analog-to-digital (successive approximation, integrating, flash and sigma-delta) and digital-to-analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time); basics of number systems, Embedded Systems: Microprocessor and microcontroller applications, memory and input-output interfacing; basics of data acquisition systems, basics of distributed control systems (DCS) and programmable logic controllers (PLC).

Unit 6: Measurements SI units, standards (R,L,C, voltage, current and frequency), systematic and random errors in measurement, expression of uncertainty - accuracy and precision, propagation of errors, linear and weighted regression. Wheatstone, Kelvin, Megohm, Maxwell, Anderson, Schering and Wien bridge for measurement of R, L, C and frequency, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling instrument, transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter; oscilloscope, shielding and grounding.

Unit 7: Sensors and Industrial Instrumentation Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular),velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (variable head, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor);liquid level, pH, conductivity and viscosity measurement. 4-20 mA two-wire transmitter.

20.3.2.2 Department of Food Engineering & Technology

Unit 1: Introductory Food Technology Introduction to food technology. Food processing industries/institutions/food scientists of importance in India. Food attributes viz. colour, texture, flavour, nutritive value and consumer preferences. Causes of food spoilage, sources of microbial contamination of foods, food borne illnesses, water activity and its relation to spoilage of foods. Spoilage of processed products and their detection. Principles and methods of food preservation. Food fortification, Composition and related quality factors for processing. Methods of food preservation such as heat processing, pasteurization, canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives. Refrigerated and modified atmosphere storage. Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing. Use of non- thermal technologies (microfiltration, bacteriofugation, ultra-high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate- thermal technologies (ohmic heating, dielectric heating, infrared and induction heating) and biological technologies (antibacterial enzymes, bacteriocins, proteins and peptides) in food processing

Unit 2: Technology of Foods of Plant Origin (a) Fruits and Vegetable Processing: Post harvest handling and storage of fresh fruits and vegetables. Preparation of fruits and vegetables for processing. Minimally processed products. Cold chain logistics. ZECC (Zero Energy

Cool Chambers), CCSR (Charcoal cool storage Rooms) Thermal processing and process time evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits, and vegetables; Dehydration and associated quality changes during drying and storage of dehydrated products. Solar drying. Intermediate moisture foods. Preparation and utilization of fruits and vegetables juices in non-fermented/ fermented/ aerated beverages, health drinks. Membrane technology. Chemistry and manufacture of pectin, role in gel and sauces. Nature and control of spoilage in these products. Re-structured fruits and vegetables. Byproducts utilization of fruits and vegetable processing industry. Processing methods of frozen fruitsand vegetables, IQF products, packaging, storage and thawing. Role of Pectinases. Tomato products such as juice, puree, paste, soup, sauce and ketchup. Other convenience foods from fruits and vegetables. Beverages, tea, cocoa and coffee processing. Medicinal and aromatic plants: their formation and products like jellies and amalades. Technology of preservatives, pickles, chutney's therapeutic values. Spice processing viz. cleaning, grading, drying, grinding, packaging and storage. Oleoresins and essential. (b) Food grain Processing: Structure, composition of different grains like wheat, rice, barley, oat, maize and millets. Anti-nutritional factors in food grains and oilseeds. Milling of grains. Wheat flour/semolina and its use in traditional/non-traditional foods like breads, biscuits, cakes, doughnuts, buns, pasta goods, extruded, confectionary products, breakfast and snack foods. Rheology of wheat and rice flour. Preparation of vital wheat gluten and its utilization. Instant ready mixtures. Enzymes (amylases and proteases) in milling and baking. Milling and parboiling of rice; by-products of rice milling and their utilization. Processed products from rice. Pearling, malting, brewing and preparation of malted milk feeds from barley. Significance of ß-glucans. Milling of oats and its processing into flakes, porridge and oatmeal. Wet and dry milling of corn, manufacture of corn flakes, corn syrup,corn starch, corn steep liquor and germ oil. Structure and composition of pulses and their importance in Indian diet. Milling and processing of pulses viz. germination, cooking, roasting, frying, canning and fermentation. Use in traditional products, protein concentrates and isolates. Modified starches and proteins. Oilseeds: edible oilseeds, composition and importance in India. Oilseed processing. Oil extraction and its processing, by-products of oil refining. Production, packaging and storage of vanaspati, peanut butter, protein concentrates, isolates and their use in high protein foods. Export ofoilseed cakes. International market and consumer preferences for quality in cakes for use in textured vegetable proteins. Millets: composition, nutritional significance, structure and processing. Dairy analogues based on plant milk. Spices Processing: Oleoresin and essential oil extraction.

Unit 3: Technology of Foods of Animal Origin (a) Technology of Milk and Milk Products: Milk and Milk production in India. Importance of milk processing plants in the country. Handling and maintenance of dairy plant equipment. Dairy plantoperations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. Problems of milk supply in India. UHT, toned, humanized, fortified, reconstituted and flavoured milks. Technology of fermented milks. Milk products processing viz. cream, butter, ghee, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice-cream, butter oil, khoa, channa, paneer and similar products. Judging and

grading of milk products. Cheese spreads by spray and roller drying techniques. EMC (Enzyme modified cheese), Enzymes in dairy processing. In sanitization viz. selection and use of dairy cleaner and sanitizer. In plant cleaning system. Scope and functioning of milk supply schemes and various national and international organizations. Specifications and standards in milk processing industry.Dairy plant sanitation and waste disposal. (b) Technology of Meat / Fish / Poultry Products: Scope of meat, fish and poultry processing industry in India. Chemistry and microscopic structure of meat tissue. Ante mortem inspection. Slaughter and dressing of various animals and poultry birds. Post mortem examination. Rigor mortis. Retails andwholesale cuts. Factors affecting meat quality. Curing, smoking, freezing, canning and dehydrationof meat, poultry and their products. Sausage making. Microbial factors influencing keeping qualityof meat. Processing and preservation of fish and its products. Handling, canning, smoking and freezing of fresh water fish and its products. Meat tenderization and role of enzymes in meat processing. Utilization of by-products. Zoovosic diseases. Structure and composition of egg and factors effecting quality. Quality measurement. Preservation of eggs using oil coating, refrigeration, thermo stabilization and antibiotics. Packing, storage and transportation of eggs. Technology of egg products viz. egg powder, albumen, flakes and calcium tablets. Industrial and food user physiological conditions and quality of fish products.

Unit 4: Food Quality Management Objectives, importance and functions of quality control. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability. The principles and practices of food plant sanitation. Food and hygiene regulations. Environment and waste management. Total quality management, good management practices, HACCP and codex in food. International and National food laws. US- FDA/ISO-9000 and FSSAI. Food adulteration, food safety. Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis quality control. Quality control of food at all stages and for packaging materials. Non-destructive food quality evaluation methods.

Unit 5: Food Engineering/Packaging and Labelling Unit operations of food processing viz. grading, sorting, peeling and size reduction machineries for various unit operations, energy balance in food processing. Packaging materials viz. properties and testing procedures, packaging of fresh and processed foods. Shelf life studies. Recent trends in packaging, aseptic, modified atmosphere, vacuum and gas packaging. Nutritional labelling requirements of foods. Requirements and functions of containers. Principles of package design.

Unit 6: Food Microbiology & Biotechnology Fermentation technology, fermented food products (animal and plant based), microbial spoilage of foods, bacterial growth curve, hurdle technology. Role of biotechnology in productivity of plants, livestock and microbes of improved nutrition and quality. Use of biotechnology in production of food additives viz. preservatives, colorants, flavours. Use of biotechnologically improved enzymes in food processing industry, biomass production using industrial wastes. Single cell proteins, Food contaminants viz. aflatoxins. Food intoxication and infection. Consumer concerns about risks and values, Biotechnology and food safety.

Unit 7: Flavour Chemistry Technology 'Flavour composition of foods/beverages (identi-

fication and quantitative analysisof the flavour precursors and their products, characterization of the staling reaction using stable isotopes). Flavour composition of foods/beverages in relation with maturation and microbial activity/or the processing conditions (e.g. fermented dairy products, beer, wine, honey, fruits). Analysis of odour-active compounds of food/beverages (Charm analysis). Synthesis of flavour by microorganisms and plant cells. Lipid derived flavours. Investigation of equilibrium of key flavour compounds that govern the flavour stability of beverages. Natural antioxidant constraints in spices. Role of microorganisms inflavour development. Flavor emulsions, flavour composites, essential oils and oleoresins.

Unit 8: Consumer Sciences / Food Product Development / Health Foods Socio-cultural, psychological and economical consideration for food appearance, domestic and export marketing. Consumer trends and their impact on new product development. Product development viz. to conceive ideas, evaluation of ideas, developing ideas into products, test marketing and commercialization. Role of food in human nutrition. Nutritional disorders, natural contaminants and health hazards associated with foods. Diet therapy. Therapeutic / Engineered / Fabricated and Organic foods/ Nutraceutical and functional foods.

20.3.2.3 Department of Civil Engineering

Geotechnical Engineering

Unit 1: Soil Mechanics

Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction; One-dimensional consolidation, time rate of consolidation; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.

Unit 2: Foundation Engineering

Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, Standard Penetration Test(SPT), and Static Cone Penetration Tests(SCPT); pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Unit 3: Ground Improvement Techniques

Need for ground improvement; Different ground modification techniques-Mechanical modification-compaction, dynamic compaction.Prefabricated vertical drains, Dewatering and electro-kinetics. Ground treatment methods- Ground treatment with lime and cement, Grouting. Geosynthetics-Introduction to geosynthetics, types and applications, Reinforced soil.

Water Resources & Hydraulic Engineering

Unit 1: Fluid Mechanics

Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Unit 2: Hydraulics

Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy- depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow

Unit 3: Hydrology

Hydrologic cycle, precipitation, evaporation, evapotranspiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's law.

Unit 4: Irrigation

Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Environmental Engineering

Unit 1: Water and Waste Water

Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Unit 2: Municipal Solid Wastes

Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

20.3.2.4 Department of Computer Science and Engineering

Mathematics: Number system, Sets, Relations, Functions, Counting, Recurrence relations.
Algorithm: Space and time complexity measures, asymptotic notation, worst case and average case analyses, lower and upper bounds

Data structure: Array, Linked List, Stack, Queue, Tree, Graph, Search Trees, Hashing.

Concept of programming in C-language: Basic C-language syntax, Data type, Decision making, Loops, Functions, Pointer, Array, Structure, Sorting and searching Algorithms.

Theory of computation: DFA, NFA, Regular expression, Grammar, PDAOS: Basic concept of OS, Process, Scheduling, Memory management.

Networking: OSI model, TCP/IP protocol suit. IPv4.

20.3.2.5 Department of Electronics and Communication Engineering

Electronic Devices

Semiconductor physics: Effective mass equation, E-k diagram, Density of states, Fermi-Dirac distribution, Intrinsic and extrinsic semiconductors, diffusion and drift currents, Direct and indirect semiconductors. Devices: p-n junction, diode equation, solar cell, LED, BJT- current equation, transistor action and amplification, FET and MOSFET- transconductance, current equation in ohmic and saturation region. IC fabrication processes: oxidation, diffusion, ion implantation, and photolithography and twin-tub CMOS process.

Network Theory

Network solution methods: nodal and mesh analysis; Network theorems: superposition, Thevenin and Norton's maximum power transfer; Wye-Delta transformation; Steady state sinusoidal analysis using phasors; Time domain analysis of Simple linear circuits; Solution of net work equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks.

Signals and Systems

Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z- transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay.

Analog Circuits

Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op-amp configurations; Function generators, wave- shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

Digital Circuits

Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits,code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM, DRAM.

Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag- lead compensation; State variable model and solution of state equation of LTI systems.

Communications

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems; Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

Electromagnetics

Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibre.

20.3.2.6 Department of Electrical Engineering

Basic Electrical Engineering

Ohm's law, Kirchhoff's laws, mesh analysis, loop analysis, network theorems, magnetism, electromagnetism, single phase AC circuit, complex number, phasor diagram, three phase AVC circuit, instruments and ,measurements

Electrical Machines: Transformer: basic principles, construction, EMF equation, phasor diagram, equivalent circuit, open circuit test, short circuit test, losses, efficiency, voltage regulation. DC machines: construction, types of DC machines, armature reaction, characteristics, losses, efficiency.

Power systems: Fundamentals of power systems, line constant calculations, capacitance of transmission lines, corona, transients in power systems, power system stability, load flows, economic load dispatch, relays and circuit breaker, symmetrical components and fault.

20.3.2.7 Department of Humanities and Social Sciences

Subject: English

(Area: Language and Linguistics, Cultural Studies, English Language Teachings (ELT), Language Teachings)

Language and Linguistics:

Language: Meaning and rules, Language and Communication, Concepts in Lingusitcs, Language Families, Historical Comparative Linguistics, Sociolinguistics, Stylistics, The role of culture in language, Language Development and Language Maintenance

Cultural Studies:

Introduction to cultural studies, Folklore and Culture, Society and Culture, Cultural Policies and Cultural Industries, Ethnicity Identity and culture, Cultural Studies and Media, Cultural Heritage Management

ELT and Language Teachings:

Theories of Language Learning, First Language Acquisition vs. Second Language Learning, Teaching materials, Sociolinguistics context of English Teachings in India.

Subject: Economics

Indian Economy:

Basic Problem of Indian Economy, Current Indian Economic Situation, Rural Development: Issues Challenges and policy responses, Urban Development: Issues, Challenges and Policy Responses, Issues of Economic growth and Development , Social Sector Development : Health , Education and Gender , Agricultural and Industrial Development : Major Challenges and Policy Responses , Sustainable Development : Meaning and Implementation issues in India.

Technology and Economics E-commerce :

Concept and use , E – Governance System in India , Start up concept and government policy , Modern marketing concept for promotion of Entrepreneurship , Present Business and Incubation promotion Policy of Government of India.

20.3.2.8 Department of Mathematics

Real Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system asa complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation. Functions of several variables, directional derivative, partial derivative, and derivative as a linear transformation, inverse and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series,transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral,theorem, integral formula, theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

Modern Algebra: Permutations, combinations, pigeon-hole principle, inclusion- exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem,Ø- function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups,theorem, class

equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibilitycriteria. Fields, finite fields, field extensions, Galois Theory.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms.

Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness and compactness.

Numerical Analysis:

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rateof convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Calculus of Variations:

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differentialequations.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and Eigen-functions, resolvent kernel.

Ordinary Differential Equations (ODEs)

Existence and uniqueness of solutions of initial value problems for first order ordinary differentialequations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville.

Partial Differential Equations (PDEs): Lagrange and Charpit's methods for solving first order PDEs, Cauchy problem for first order PDEs, boundary value problem, Green's function, Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Classical Mechanics:

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

Statistics:

Descriptive statistics, exploratory data analysis Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate);expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities.

20.3.2.9 Department of Chemistry

Inorganic Chemistry: Chemical periodicity Structure and bonding in homo- and heteronuclear molecules, includingshapes of molecules(VSEPR Theory).

Concepts of acids and bases, Hard-Soft acid base concept,Non-aqueous solvents.

Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.

Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.

Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.

Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics inhomogeneous catalysis.

Cages and metal clusters.

Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.

Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation, metalcomplexes in medicine.

Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV- vis, NQR, MS, electron spectroscopy and microscopic techniques.

Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Physical Chemistry:

Basic principles of quantum mechanics: Postulates; operator algebra; exactly- solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals;orbital and spin angular momenta; tunneling.

Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.

Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle. π Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated -electron systems.

Chemical applications of group theory; symmetry elements; pointgroups; character tables; selection rules.

Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities selection rules; basic principles of magnetic resonance.

Chemical thermodynamics: Laws, state and path functions andtheir applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; LeChatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

Statistical thermodynamics:Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities calculations for model systems.

Electrochemistry: Nernst equation, redox systems, electrochemical cells; DebyeHuckel theory; electrolytic conductance law and its applications; ionic equilibria; conductometric and potentiometric titrations.

Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

Solid state: Crystal structures; law and applications; band structure of solids.

Polymer chemistry: Molar masses; kinetics of polymerization.

Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

Organic Chemistry

IUPAC nomenclature of organic molecules including regio- and stereoisomers.

Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.

Aromaticity: Benzenoid and non-benzenoid compounds generation and reactions.

Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.

Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reactionpathways.

Common named reactions and rearrangements applications in organic synthesis.

Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations.

Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.

Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess;enantiodiscrimination. Resolution optical and kinetic.

Pericyclic reactions electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.

Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).

Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.

Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques.

Interdisciplinary topics:

Chemistry in Nano science and technology.
Catalysis and green chemistry.
Medicinalchemistry.
Supramolecular chemistry.
Environmental chemistry

20.3.2.10 Department of Physics

Experimental Methods in Physics: Low temperature techniques and measurements, High vacuum production techniques, handling and related measurements, Radiation detection techniques and measurements, electronics, measurements and data acquisition techniques as applied to experiments, a few selected topics. Attending seminars, colloquia and interaction with the scientists.

Computational and Numerical Method

C programming language: Overview and basic concepts, data types, flow control, functions,pointers, arrays, structure, inputs / outputs, make file, libraries, parallelization, concepts of object-orientation.

Numerical methods: Introduction and sources of computational errors, solution of non-linear equations (Root finding), solution of system of linear equations, numerical interpolation, numerical differentiation and integration, solution of differential equations, solution of partial differential equations.

Data analysis: Classification of errors, error propagation, basics of Monte Carlo techniques,data interpretation using Bayesian approach.

PART-A: CORE

Mathematical Methods of Physics

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

Classical Mechanics:

Newton's laws, Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics-moment of inertia tensor. Non-inertial frames and pseudoforces. Variational principle. Generalizedcoordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation lawsand cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity-Lorentz transformations, relativistic kinematics and mass energy equivalence.

Electromagnetic Theory

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems,

Magneto-statics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields.

Quantum Mechanics:

Wave-particle duality. Schrödinger equation (time-dependent and time independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle.Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time-independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli Exclusion Principle, spin-statistics connection.

Thermodynamic and Statistical Physics

Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Microcanonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases.

Principle of detailed balance. Blackbody radiation and Planck's distribution law.

Electronics and Experimental Methods

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and heterojunction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics.

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting,

PART-B: ADVANCED

Mathematical Methods of Physics

Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and rule, Solution of first order differential equation using Runge- Kutta method. Finite difference methods. Tensors. Introductory group theory: SU(2), O(3)

Classical Mechanics

Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton- Jacobi theory.

Electromagnetic Theory

Dispersion relations in plasma. Lorentz invariance of Maxwell's equation.

Transmission lines andwave guides. Radiation- from moving charges and dipoles and retarded potentials.

Quantum Mechanics

Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts, partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

Thermodynamics and Statistical Physics

First- and second-order phase transitions. Diamagnetism, paramagnetism, and ferromagnetism. Ising model. Bose-Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to non-equilibrium processes.

Electronics and Experimental Methods

Linear and nonlinear curve fitting, chi-square test. Transducers (temperature, pressure/vacuum, magnetic fields, vibration, optical, and particle detectors). Measurement and control. Signal conditioning and recovery. Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding. Fourier transforms, lock-in detector, box-car integrator, modulation techniques.High frequency devices (including generators and detectors).

Atomic & Molecular Physics

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift,width of spectrum lines, LS & JJ couplings. Zeeman, Paschen- Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

Condensed Matter Physics

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

Nuclear and Particle Physics

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi- empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-

nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions.
Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

20.3.2.11 Department of Multimedia Communication and Design

Design ideation, Design management, Design Research, Visual Communication, Animation and multimedia, Design methodology, process and implementation, Scope in Typography, Research area specific questions. Design thinking, Problem Identification Skills and problem solving.

Candidates must be able to recognize the user and the context, knowledge of properties of materials and their felicitous use in design and many more and the user and the constraints and select the most relevant solution for the given design problem.

Observation and design sensitivity: Candidates must have the ability to observe the hidden properties in day to day life and think rigorously about them. Aspiring students must be able to notify the variance in visual properties and aesthetic outcomes.

Drawing Creativity: Aspiring candidates must be skilled in drawing products, people or scenes, together with good line quality, composition, proportion, perspective, and shading. Candidates must have the ability of lateral thinking and suggest solitary along with diverse solutions.

Communication Skills: Students must have good communication skills. Candidates must be able to convey concept and idea distinctively by virtue of text and visuals.

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