

Indian Institute of Technology Dharwad



॥ सा विद्या या विमुक्तये ॥

Information Brochure

Ph.D. Admissions

(For Indian Nationals)

Autumn Semester 2023-24
(Additional Round)

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A. SCHEDULE OF Ph.D. ADMISSION

Sr. No.	Description	Relevant dates*
1.	Applications open	19 th June 2023
2.	Last Date to apply online	30 th June 2023
3.	Announcement of shortlist of eligible candidates	1 st July 2023
4.	Interview Schedule	2 nd July 2023 to 9 th July 2023
5.	Declaration of provisional list of selected & waitlisted candidates	14 th July 2023
6.	Admission process for recommended candidates	14 th July 2023 to 19 th July 2023
7.	Admission for waitlisted candidates	20 th July 2023 onwards

***All deadlines are defined exactly to be at 5:00pm on the respective date.**

All potential candidates are requested to keep visiting the institute website regularly for updated information about the admission process. **Future updates regarding the admission process will be made available on the [institute website](#) under section Academics >> Admissions >> [Ph.D.](#)**

B. APPLICATION CATEGORIES & FINANCIAL SUPPORT

IIT Dharwad admits Ph.D. candidates as full time students with research scholarship or Teaching Assistantship (TA) or Project Assistantship (PA). Also, part-time externally sponsored research scholars or institute staff can be admitted. However, **each department may not have openings in all the following modes of support.** More details can be found in the departmentspecific section in this document.

B.1. Teaching Assistantship (TA)

Funded by the Ministry of Education (MoE), Government of India, the TAs are expected to assist in the academic/administrative work for smooth functioning of the Institute.

Students under this category are entitled to the financial support as per the MoE norms.

1. For students with M.Tech./M.E./M.Sc.(Engg.)/M.Phil. or equivalent degree as the qualifying degree, the assistantship is payable for a maximum duration of 5 years or up to the thesis defence, whichever is earlier. At present, the monthly rate of assistantship is ₹31,000 for the first 2 years and enhanced rate of ₹35,000/- for the remaining 3 years and HRA as per rules.
2. The students awarded with Teaching Assistantship must assist in teaching, research and/or administrative work as assigned by the respective Academic Unit to the extent of 8 hours of work per week.
3. The continuation of the assistantship will be subject to the satisfactory performance of the duties assigned by the Departments as well as satisfactory academic and research performance.
4. As per MoE directives, the employees on the rolls (with or without pay) of any organization are not eligible for admission under this category. Candidates selected in this category have to resign from the current job and submit a relieving letter from their employer before joining the programme.
5. Students getting assistantships from the Institute may join projects sponsored by external agencies and obtain corresponding fellowships in lieu of TA ship.
6. The reservation to various social categories is applicable as per the Govt. of India norms.

B.2 Fellowship Awardee (FA)

B.2.1 Description – FA

The financial support under this category is provided by various Government / Semi Government schemes (for example, CSIR, UGC, DAE, DST, DBT, NBHM, etc.) and some other organizations. A valid Junior Research fellowship (JRF) award letter from the Government / Semi Government agencies (e.g. CSIR / UGC / DAE / DST / DBT / NBHM / (confirmed) DST INSPIRE, etc.) are required for the execution of this fellowship.

The amount, duration of the fellowship, and HRA will be as specified by the awarding agency. The disbursement and continuation of the fellowship will be subject to as per the norms specified by the awarding agency or specified by IIT Dharwad, as deemed fit.

B.2.2 PMRF: A brief Note on Prime Minister's Research Fellowship

The Prime Minister's Research Fellows (PMRF) Scheme has been designed for improving the quality of research in various higher educational institutions in the country. With attractive fellowships, the scheme seeks to attract the best talent into research thereby realizing the vision of development through innovation. The scheme was announced in the Budget 2018-19. The institutes which can offer PMRF include all the IITs, all the IISERs, Indian Institute of Science, Bengaluru and some of the top Central Universities/NITs that offer science and/or technology degrees. The candidates will be selected through a rigorous selection process and their performance will be reviewed suitably through a national convention.

B.3 Project Assistantship (PA)

Funded from projects sponsored by industries and government funding agencies. Under this category, candidates will be paid fellowship as per the rules & regulations of the governing project.

B.4 Externally sponsored Ph.D. (EX)

The candidates employed in recognized R&D organizations and desirous of pursuing Ph.D. programme while in employment may apply for admission as external candidates. **The option of external registration is for applicants who are working in well-equipped scientific institutions, laboratories, R&D establishments and industrial organizations engaged in research based activities. Persons working in colleges/universities are not eligible under this category.** After fulfilling the coursework requirement at the Institute, these candidates will be allowed to register for Ph.D. with a Supervisor (internal) from the Institute and a Co-supervisor (external) from their parent organization where they will be doing the research work. The admissions are based on the following norms:

1. The competence of these candidates will be assessed along with the regular candidates.
2. Along with application, the candidate should submit a Sponsorship Certificate (Appendix A) from the organization in which he / she is employed giving an undertaking that the candidate would be released from the normal duties to fulfill the coursework requirement (and qualifier examination, if applicable). The certificate should also provide details of facilities relevant to the research programme and available to the candidate.
3. The candidate is required to be at the Institute as a full-time student for the coursework (and qualifier examination, if applicable) of his/her Ph.D. Programme. The coursework requirement is likely to be a period of 1-2 semesters. Depending on the student's background and the programme requirements, an additional semester may be needed to complete the coursework/qualifier examination.

4. To promote interaction between the internal supervisor and external co-supervisor, meetings between them should be arranged at least once in a year in the Institute or in the sponsoring organization.
5. The Ph.D. registration of an external candidate would be reviewed at the end of each year from the date of registration in terms of his progress in courses / seminars / approved research programme by a Research Progress Committee (RPC) nominated by the concerned Department Postgraduate Committee (DPGC).
6. At the time of joining the programme, the students will have to produce a “Relieving certificate” from his / her employer that he / she has been fully relieved from normal duties during the semester(s) to complete the course work and other academic work at IIT Dharwad.

B.5 Institute Staff for Ph.D.

Existing employee of IIT Dharwad can be admitted under the category Institute Staff subject to fulfillment of conditions mentioned in the PhD Rule Book.

Based on the information provided by the applicants a list of the eligible candidates called for the selection process will be declared on the Institute website on the date specified in the schedule. Only the eligible candidates are permitted to participate in the selection process.

C. GENERAL GUIDELINES for APPLYING ONLINE

1. Please read all the instructions given in the brochure carefully before filling up the application form.
2. **Please note that the application is to be filled at one go.** There is no save and proceed option. The application process flow is given below:
 - a. **The institute application form should be filled first**, the form contains general information such as your name, category, email id, contact details, address and most importantly preference for departments (especially for those candidates who want to apply for more than one department).
 - b. After the successful submission of the institute form, a Submission Id is generated and the same to be noted for all future references.
 - c. After filling the institute form, department specific application form should be filled.

Please note that it is mandatory to fill both institute and department specific application forms. Failure to submit both the forms leads to non- consideration of your application for the selection process.

Only the applicable single application fee should be paid per applicant irrespective of the number of the departments applicant is applying to.

3. Keep all the documents handy >> pay the application fee through SBI e collect facility >> Note down SBI e collect reference No>> Start online application form>> Fill all particulars including SBI e collect reference No>> Take a print/ save a pdf copy of preview of completed application form >> Final submission of application form >> Note down submission ID for future reference
4. This information brochure and future updates regarding the admission process will be made

available on the institute website under section Academics >> Admissions >> Ph.D.

5. You are required to submit the application form online. There are no downloadable forms available. After filling the form, you are advised to take a print and keep the same for future reference.
6. The application fee is as follows: Please visit the link given below and choose “Application Fee (M.Tech/MS/PhD)”, fill all the particulars and chose an amount based on your social category. **Please submit and note down the transaction reference number to be mentioned in the application form as well as for future reference.**

[State Bank Collect \(onlinesbi.sbi\)](https://onlinesbi.sbi)

Gen/Gen (EWS)/OBC/ all other candidates	₹ 200/-
Women/SC/ST/PwD category candidates	₹ 100/-

7. **The Application Form without valid online payment details will not be considered. Application FEE once paid is Non-Refundable.**
8. Applicants may find it convenient to keep following information handy while filling the application form online (whichever relevant). This is especially important as the form cannot be saved and as such once started one needs to complete the entire form and submit:
 - Skype Id or Gmail Id for G-meet
 - Passport size photo whose size is less than 50 kb
 - Educational details from secondary school onwards
 - GATE qualification details
 - Statement of Purpose (pdf file)
 - List of fellowship/ awards
 - Publications
 - Sponsorship Letter and CV of co-supervisor if you are applying under ‘EX’ category.
 - JRF Award Letter if you are applying under ‘FA’ category, if applicable.
 - Any other achievements/information.
9. Amendments to the form will not be possible once the last date to apply online is over. However, amendments can be considered if the applicant resubmits the entire form without making repeat fee payment before the deadline.
10. **Keeping checking the institute website and your emails regularly for any communication from the institute regarding the selection process. It is candidate’s responsibility to be aware about the schedule of various events related to the admission process.**
11. The Shortlisted candidates’ list will be uploaded on the institute website as per the schedule given above in Section A.
12. Candidates (if) called for written test / interview should bring with them Photo ID Card, Printed Copy of Online Application Form, Photocopies of Academic Transcripts, Degree Certificates & Experience Certificates, Caste Certificate (if applicable), PwD Certificate (if applicable), EWS Certificate (if applicable), Thesis/Dissertation/Report/Publications and all other relevant documents.
13. **Please note that the candidates (if selected) should be able to produce all relevant documents within a short period of notice. If the documents are not produced within the deadline, the admission is liable to be cancelled.**

D. INFORMATION PERTAINING TO HOSTELS

About IIT Dharwad	Kindly visit the website https://www.iitdh.ac.in/ for available facilities
Hostel Room Allocation (on sharing basis)	You will be allotted a room in the hostel & the room key will be handed over on your arrival at the Institute. Each room will accommodate roughly two/four students (depending on the prevailing conditions) and has an attached bath & toilet.
Are hostel rooms furnished	Each student will be provided a cot, chair & study table and wardrobe. Students can purchase mattress/bedding, bucket, etc. locally. Arrangements will be made for on-campus shopping for these items.
Possession of motorized vehicle	NOT ALLOWED, however bicycles are permitted in the campus.
Climatic conditions	The weather at Dharwad is pleasant throughout the year. Generally, it will be raining in the months of June to September and weather will be windy and cold during the months of October to January. It is suggested that you carry protective clothing accordingly.

E. FEES, DEPOSITS & HOSTEL RENT

The tentative fee applicable for admission to PhD programme for Autumn 2023-24 is provided below for reference purpose. **The actual fee to be paid will be made available at the time of declaration of final results.**

E.1 Details of Applicable Fee for Admission:

E.1.1 TA Category

S. No.	Fee Amount (In Rs.)	For General/ General (EWS)/OBC (NCL)	For SC/ST/PwD
A. One-time payment at the time of Admission			
1.	Admission Fee	2,200.00	2,200.00
2.	Thesis Fee	2,500.00	2,500.00
3.	Medical examination	400.00	400.00
4.	Provisional certificate	500.00	500.00
5.	Student Welfare Fund	1,000.00	1,000.00
6.	Modernisation & Upgradation	2,500.00	2,500.00
7.	Identity Card	500.00	500.00
8.	Convocation Fee	3000.00	3000.00
9.	Alumni Fee	1000.00	1000.00
Sub-Total (A)		13,600.00	13,600.00
B. Semester Fee			
^1.	Tuition Fee – Statutory Fee	2,500.00	Nil
2.	Examination Fee	1,000.00	1,000.00
3.	Registration Fee	750.00	750.00
4.	Gymkhana Fee	5,000.00	5,000.00
5.	Student Benevolent Fund	500.00	500.00
6.	Medical Fee	1,500.00	1,500.00
*7.	Hostel Room Rent	2,000.00	2,000.00
*8.	Electricity & Water Charges	3,000.00	3,000.00
*9.	Hostel Establishment Charges	3,000.00	3,000.00
*10.	Mess Establishment Charges	1,550.00	1,550.00
Sub-Total (B)		20,800.00	18,300.00
*11.	Mess Fee Advance	24,500.00	24,500.00
C. Deposits (Refundable) to be paid at the time of Admission			
1.	Institute Security Deposit	1,000.00	1,000.00
2.	Library Security Deposit	1,000.00	1,000.00
3.	Mess Security Deposit	1,000.00	1,000.00
Sub-Total (C)		3,000.00	3,000.00
GRAND TOTAL FEE (A + B + C+ Mess Advance)		61,900.00	59,400.00

E.1.2 PA/EX/FA Category

S. No.	Fee Amount (In Rs.)	For General/ General (EWS)/OBC (NCL)	For SC/ST/PwD
A. One-time payment at the time of Admission			
1.	Admission Fee	2,200.00	2,200.00
2.	Thesis Fee	2,500.00	2,500.00
3.	Medical Examination	400.00	400.00
4.	Provisional Certificate	500.00	500.00
5.	Student Welfare Fund	1,000.00	1,000.00
6.	Modernisation & Upgradation	2,500.00	2,500.00
7.	Identity Card	500.00	500.00
8.	Convocation Fee	3000.00	3000.00
9.	Alumni Fee	1000.00	1000.00
Sub-Total (A)		13,600.00	13,600.00
B. Semester Fee			
^1.	Tuition Fee – Statutory Fee	25,000.00	Nil
2.	Examination Fee	1,000.00	1,000.00
3.	Registration Fee	750.00	750.00
4.	Gymkhana Fee	5,000.00	5,000.00
5.	Student Benevolent Fund	500.00	500.00
6.	Medical Fee	1,500.00	1,500.00
*7.	Hostel Room Rent	2,000.00	2,000.00
*8.	Electricity & Water Charges	3,000.00	3,000.00
*9.	Hostel Establishment Charges	3,000.00	3,000.00
*10.	Mess Establishment Charges	1,550.00	1,550.00
Sub-Total (B)		43,300.00	18,300.00
*11.	Mess Fee Advance	24,500.00	24,500.00
C. Deposits (Refundable) to be paid at the time of Admission			
1.	Institute Security Deposit	1,000.00	1,000.00
2.	Library Security Deposit	1,000.00	1,000.00
3.	Mess Security Deposit	1,000.00	1,000.00
Sub-Total (C)		3,000.00	3,000.00
GRAND TOTAL FEE (A + B + C+ Mess Advance)		84,400.00	59,400.00

Note:

- All the SC/ST/Divyangjan students are exempted from payment of Tuition fee.
- *Students not staying in the campus or not provided married accommodation are not required to pay fee at sl. no. 7, 8, 9, 10 & 11.
- ^IIT Dharwad reserves the right to revise the Tuition Fee-Statutory Fee (infuture).

F. DEPARTMENT OF BIOLOGICAL SCIENCES AND BIOENGINEERING

F.1 ELIGIBILITY FOR ADMISSION

F.1.1 Qualifying Degree

- **MTech/M.Sc.** or equivalent in Bioinformatics/ Chemistry/Biotechnology/Microbiology/life-sciences or other allied biology subjects.
- Junior Research Fellowship (JRF) of CSIR/UGC/DST INSPIRE/DBT/MHRD/ICMR or any other relevant funding agencies is mandatory for FA category. Applicant who are waiting the results of fellowship exam can apply. However, students must have the fellowship before the announcement of the results.

Mere fulfilling the eligibility criterion does not guarantee shortlisting or final selection.

F.1.2 Minimum score in the qualifying degree

For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, the eligibility criteria in the qualifying degree (MTech. /MSc.):

1. A minimum of 60% marks (without round off) in aggregate, OR,
2. A minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).

For SC/ST category candidates and differently abled candidates (PwD), a relaxation of 5% (or CPI/CGPA of 0.5 on the scale of 0-10) in the qualifying degree is applicable.

F.1.3 Eligibility of applicants in the final phase of getting the qualifying degree

Students who are in the final phase of receiving above mentioned qualifying degree and who are likely to graduate before commencement of Autumn 2023-24 semester of IIT Dharwad are also eligible to apply. However, if offered, admission to those candidates would be provisional. To join academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining mentioned in Section A above. They need to meet the criteria specified in the section above considering updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission mentioned in section A should be used to determine eligibility for application and same to be reported in the online application.

F.2 MODALITY OF THE SELECTION PROCESS

The selection process will comprise of an offline interview process. All the eligible candidates will be called for onsite interview/s at BSBE Department IIT Dharwad. For the syllabus, please refer to the section below.

F.3 SYLLABUS

For the onsite interviews, the following syllabus will be followed. Candidates can expect questions based on aptitude and reasoning as well.

Bioinformatics: Statistics, Descriptive statistics, Correlation and regression, basic machine

learning, Hypothesis Testing, Probability theory,

Biophysics: Raman spectroscopy, Absorption spectroscopy, Fluorescence spectroscopy, and NMR.

Biochemistry, Microbiology, Molecular & Cell Biology, Genomics: Biomolecules, Metabolism, Membrane transport, Structure and regulation of prokaryotes and eukaryotes genes, Transcription, Translation, Post-transcriptional and Translational modifications, Molecular interaction, Molecular markers, Genetic and physical mapping, Gene interaction; Population genetics, Genetic engineering; Cloning and expression vectors, rDNA technology, Gene cloning approaches, Whole-genome sequencing & annotation, High throughput gene expression, and Function elucidation technologies, PCR, Blotting Techniques, Gene transfer technologies, Protein-protein interactions, Mass spectrophotometry, Signal transduction pathways, and their elucidation, Primary and secondary metabolic pathways, Systems biology frameworks for metabolic engineering, Nano biotechnology, Genomics, and proteomics.

F.4 Focus area of research

- 1.Cancer biology
- 2.Metabolomics using Raman spectroscopy.

F.5.1 Fellowship Awardee (FA)

In this call, applications are invited under FA category for research areas number 1 and 2.

G. DEPARTMENT OF CHEMICAL ENGINEERING

G1. ELIGIBILITY FOR ADMISSION

G1.1 Qualifying Degree

M.Tech./M.E./M.Sc.(Engg.) or equivalent degree in Chemical Engineering or any related stream.

G1.2 Minimum score required in the qualifying degree and GATE Qualification

For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, the eligibility criteria in the qualifying degree (M.Tech./M.E.):

- 1) a minimum of 60% marks (without round off) in aggregate, OR,
- 2) a minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).

For SC/ST category candidates and differently abled candidates (PwD), a relaxation of 5% (or CPI/CGPA of 0.5 on the scale of 0-10) in the qualifying degree is applicable

G1.3 Eligibility of applicants in the final phase of getting the qualifying degree

Students who are in the final phase of receiving the above-mentioned qualifying degree and who are likely to graduate before commencement of Autumn 2023-24 semester of IIT Dharwad are also eligible to apply. However, if offered, the admission to those candidates would be provisional. To join an academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining mentioned in Section A above. They need to meet the criteria specified in the section above considering updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission mentioned in section A should be used to determine eligibility for application and same to be reported in the online application.

G2. Modality of selection process

We will conduct a online interviews for our PhD selection process, which is highly competitive. Only eligible applicants will be permitted to participate in the selection process, which is designed to evaluate the applicant's research potential, academic background, and motivation for pursuing a PhD in Chemical Engineering. The first round of the interview process will be conducted in online mode and will consist of a detailed discussion on the applicant's research interests and academic background. This round is aimed at evaluating the applicant's research potential and identifying candidates who have a strong foundation in the field of chemical engineering based on fundamentals. The second round of the interview process will be conducted online mode to gain an in-depth understanding of our research programs. This round is designed to assess the applicant's research skills, scientific reasoning, and suitability for our PhD program.

G3. Focus area of research

The following topics are floated in the Department of Chemical Engineering for the PhD program this semester. Applicants have to choose at least one of these topics and fill in the application form. The broad areas of research will be in the following fields: Our PhD program is aimed at developing the next generation of innovators and leaders in the field of chemical engineering. We encourage all eligible applicants to apply for our program and look forward to welcoming the most promising candidates to our department.

1. Multiphase Flows:
 - Computational fluid dynamics modeling of oil sand tailings transport in industrial pipelines.
 - Insights on bitumen aggregation and breakage in oil sand tailings slurry transport pipelines
 - Numerical simulation of particle/bubble interactions in slurry bubble columns
2. Microfluidics:
 - Design and optimization of microchannel geometries for controlling droplet formation and transport
 - Investigation of droplet-substrate interactions and surface wetting phenomena in constricted microchannels
 - The rheological properties and their impact on droplet dynamics (e.g., shear-thinning, shear-thickening, viscoelastic fluids) in constricted microchannel.
3. Molecular modeling and simulation of macromolecules to accelerate energy and healthcare innovation
4. Development of novel electrolyte materials for use in clean and renewable energy technologies
5. Understanding of transport barriers in next-generation nano-bio materials
6. Adsorption and Diffusion in Metal-Organic Framework Materials
7. Controlled Drug Delivery through cross-linked polymer systems: A Molecular Dynamics Investigation

G4. interview Instructions:

If you have been shortlisted for the interview process, you will be invited to participate in an online interview. The online interview will be conducted via Google Meet, and you will receive detailed instructions and a link to access the interview prior to the scheduled date. Here are some important guidelines to follow during the online interview:

1. Technical requirements: Make sure you have a reliable internet connection and a functioning webcam and microphone on your computer or device. You should also test your equipment and internet connection in advance to ensure that they are working properly.
2. Log in to the video conferencing software at least 10 minutes prior to the scheduled interview time.
3. During the interview, speak clearly, maintain good eye contact, and be professional in your demeanor. Remember to listen carefully to the interviewer's questions and respond thoughtfully.
4. Find a quiet and distraction-free space for the interview to avoid windy noisy. Turn off any notifications on your phone or computer to minimize disruptions.
5. Ensure that equipment is charged to avoid power issues.
6. Do not record interviews in any form. Any such act will be considered as violation of the pledge you signed online and may invite punitive action from IIT Dharwad.

H. DEPARTMENT OF CHEMISTRY

H.1. Eligibility for Admission

H.1.1. Qualifying Degree

M.Sc. or equivalent degree in any area of Chemistry/Biochemistry/Biotechnology and/or any other related areas.

The candidates must also fulfill **any one** the following additional requirements:

- **Valid GATE Score** or M.Phil or M.Tech./M.E. or equivalent degree in chemistry (for **TA & PA categories**)
- **Junior Research Fellowship** (JRF) of CSIR/UGC/DST INSPIRE/DBT/MHRD/ICMR or any other relevant funding agencies (**for FA category**)

H.1.2. Minimum score in the qualifying degree

1. For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, the eligibility criteria in the qualifying degree is First Class, as specified by the candidate's Institution/University. If the Institution/University does not specify the division/class, then one of the following will be considered as the eligibility criteria:
 - a minimum of 60% marks (without round off) in aggregate. (OR)
 - a minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).

For SC/ST/PwD category candidates, a relaxation of 5% in the qualifying degree is applicable.

H.2. Modality of the Selection Process

Only the eligible applicants are permitted to participate in the selection process.

The selection process comprises one **round of online interviews**.

H.3. Syllabus

- Organic Chemistry
Recommended textbooks: J. Clayden, N. Greeves, S. Warren
- Inorganic Chemistry
Recommended textbooks: J. E. Huheey, E. A. Keiter, R. L. Keiter
- Physical Chemistry
Recommended textbooks: Atkins' Physical Chemistry
- Spectroscopy
Recommended textbooks: C. N. Banwell and D. L. Pavia
- Biochemistry
Recommended textbooks: Lehninger principles of biochemistry by Nelson and Cox

H.4. Focus area of research

The broad areas of research will include organic chemistry, biochemistry, and chemical biology, organometallic chemistry, materials chemistry and computational chemistry. Students will have

exposure to different interdisciplinary areas of chemistry, protein biochemistry and material science. The Department of Chemistry admits Ph.D. candidates under the Teaching Assistantship (TA), Project Assistantship (PA)* and Fellowship Assistantship (FA) category for this round of admissions in the following research areas.

(*Note: The offer in the PA category is subject to availability of the funds)

1. Functional π -conjugated compounds: The π -conjugated compounds (oligomers, one-dimensional and two-dimensional polymers) are of great importance in semiconducting applications because electron delocalization along the π -conjugated backbone gives rise to interesting electronic and optical properties. Thus, the π -conjugated compounds have been well explored for various applications in molecular electronics such as organic field effect transistors (OFETs), Organic light emitting diodes (OLEDs), solar cells, fluorescent/resistive sensing and photocatalysis. Thus, our group is interested in developing new π -conjugated organic compounds using novel synthetic routes and exploring their applications in organic materials with a particular interest in fluorescent sensing and photocatalytic applications for organic transformations and hydrogen evolution.

2. Bio-organic Chemistry and Chemical Biology:

Enzymes are nature's organic chemists that carry out remarkable chemical reactions, particularly in the synthesis of antibiotics and other important drug compounds. To study enzyme reaction mechanisms, one requires sound knowledge of chemistry and biochemistry. Our area of research involves studying the organic chemistry of enzymes involved in the synthesis of biologically active compounds (anticancer, antibacterial, antifungal etc.). Some natural products that we focus in the lab are ribosomally synthesized and post-translationally modified (RiPP) peptide natural products, non-ribosomal natural products and nucleoside based compounds. All these have impressive antibacterial properties to combat antibiotic resistance, a global health threat nowadays. We study the chemistry of the enzyme mechanisms (such as C-H activation, C-C bond formation, molecular rearrangement, amide bond activation, peptide bond formation etc.) involved in synthesizing these natural products. We employ interdisciplinary techniques from chemistry (synthetic organic chemistry, physical organic chemistry, spectroscopic techniques, inorganic chemistry, and anaerobic techniques), biochemistry/chemical biology, protein chemistry, molecular biology, and microbiology during these studies. Suitable collaborations (such as for protein crystallography, complex organic synthesis, EPR techniques, proteomics, and synthetic biology etc.) will be initiated to gain insights into the molecular details of these enzymatic mechanisms. In addition, analog generation for medicinal chemistry, enzyme inhibitors development and structure- function elucidation of new compounds will also be undertaken in the future for drug design. Students will get exposure to synthesis, biochemistry, molecular biology, and various spectroscopic techniques.

3. Surface Organometallic Chemistry: Organometallic complexes are widely known for their reactivity in coupling reactions, dehydrogenations, C-H or C-X (X= N, O, Cl, Br, F) activations, transfer hydrogenations, metathesis, polymerization, Michael addition etc. Most of the industrial processes comprise heterogeneous catalysts. The surface organometallic chemistry unifies the benefits of homogeneous and heterogeneous catalysis. The most common approach is immobilization of molecular complexes on support. The advantages offered by immobilization are ease of separation and recyclability can be privileged for a chemical reaction. These integrated systems will be made in a way that can be applied to reactions which are difficult to achieve otherwise e.g., conversion of renewable raw materials CO₂, CO, H₂, N₂ into value added chemicals and biomass valorization among others through thermal or photochemical activations.

4. Computational Chemistry: We employ density functional theory (DFT) based computational techniques to study various problems in chemistry and material science. Our current research interests are designing electrocatalysts for nitrogen reduction reactions to ammonia. In this project,

we will be employing high-throughput based calculations in conjunction with molecular dynamics simulations for rational catalysts design. We are also interested in studying the covalent organic frameworks based organic electrodes for alkali ion batteries using computational methods.

5. For Project Assistantship (PA)

Title: Development of fluorescent and resistive sensors for monitoring the crop health via detection of plant emitted volatile organic compounds (VOCs)

Description: This project involves development of fluorescent sensors based on organic small molecules and the polymers.

Broad domain of research: Organic synthesis, characterization and fluorescent sensors

Requirement: The candidate should have exposure to the basics of organic chemistry, spectroscopy and fundamental knowledge on photophysical properties.

Type of funding support – PA (Rs. 31000/- additional HRA applicable if staying outside campus; it may vary as per the policy applicable from time to time)

Duration of funding - 3 years, **Number of openings:** 1

I. DEPARTMENT OF CIVIL ENGINEERING

I.1 Qualifying Degree

M.Tech. or equivalent degree in Civil Engineering with the specialization of Geotechnical Engineering or Structural Engineering (or any other equivalent PG specialization in Civil Engineering)

I.1.1. Minimum score required in the qualifying degree and GATE Qualification

For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, the eligibility criteria in the qualifying degree (MTech. /M.E.):

- A minimum of 60% marks (without round off) in aggregate, OR,
- A minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).
- Candidate must qualify in GATE at least once (Candidate need not to have a valid GATE score) OR Candidate must have CGPA > 8.0 in masters from IIT or NITs OR Candidate must have one SCI indexed journal publication as a first/second author.

For SC/ST category candidates and differently abled candidates (PwD), a relaxation of 5% (or CPI/CGPA of 0.5 on the scale of 0-10) in the qualifying degree is applicable. However, candidate must qualify in GATE at least once (Candidate need not to have a valid GATE score) OR Candidate must have at least one SCI indexed journal publication as a first/second author.

I.1.2. Eligibility of applicants in the final phase of getting the qualifying degree

Students who are in the final phase of receiving the above-mentioned qualifying degree and who are likely to graduate before commencement of Autumn 2023 semester of IIT Dharwad are also eligible to apply. However, if offered, the admission to those candidates would be provisional. To join an academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining mentioned in the Section A above. They need to meet the criteria specified in the section above considering updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission mentioned in section A should be used to determine eligibility for application and same to be reported in the online application.

I.2. Modality of selection process

Only the eligible applicants are permitted to participate in the selection process. The shortlisted candidates will be called for interview by the respective panel based on the research area preference mentioned in the admission form. The selection process would involve two rounds (online mode).

Round 1: Candidates must make a presentation of their own research work for 10 minutes duration. Instructions: (a) The First slide must contain candidates' brief biodata. (b) The last slide must contain a prospective Ph.D. research problem statement.

Round 2: Round 1 selected candidates will be called for a technical interview. The technical interview will be based on the Civil Engineering GATE equivalent syllabus.

The candidates are encouraged to check the Institute Website from time to time. Selection committee decisions are final in all matters including any disciplinary matters/malpractice.

I.3. Focus area of research

Geotechnical Engineering: Unsaturated soils, Energy Geotechnics, Geotechnical Earthquake Engineering, Slopes and Landslides, Ground Improvement Techniques, Geosynthetics, Retaining Walls and Deep Excavations, Pavement Geotechnics, Buried Pipelines.

Structural Engineering: Structural Dynamics, Earthquake Engineering, Structural Fire Engineering, Steel Structures, Light Weight Portable Structures, Multi-Hazards, Retrofitting of Structures, High Strength Concrete.

I.4. Teaching Assistantship (TA)

The positions mentioned below are available for Gen, OBC-NCL, SC, ST and PwD categories.

I.4.1. Position 1

Code – AU23_Civil_PhD_TA1

Broad domain of research – Geotechnical Engineering

I.4.2. Position 2

Code – AU23_Civil_PhD_TA2

Broad domain of research – Geotechnical Engineering

I.4.3. Position 3

Code – AU23_Civil_PhD_TA3

Broad domain of research – Geotechnical Engineering

I.4.4. Position 4

Code – AU23_Civil_PhD_TA4

Broad domain of research – Structural Engineering

I.4.5. Position 5

Code – AU23_Civil_PhD_TA5

Broad domain of research – Structural Engineering

I.5. Externally Sponsored (EX)

In this call, applications are invited under EX category for all research areas mentioned above. The candidates will be shortlisted as per the rules mentioned in B.4 section and I.1 Section.

J. DEPARTMENT OF ELECTRICAL ENGINEERING

J.1. Eligibility Criterion

J.1.1. Qualifying Degree

M.Tech., MS, ME or equivalent degree in Electrical Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Instrumentation Engineering, Computer Science and Engineering, or any related stream.

OR

MSc in Mathematics and Statistics with valid GATE or NET scores, or any related stream.

J.1.2. Minimum score in the qualifying degree

For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, the eligibility criteria in the qualifying degree (M.Tech./M.E/MSc):

1. a minimum of 60% marks (without round off) in aggregate, OR,
2. a minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).

For SC/ST category candidates and differently abled candidates (PwD), a relaxation of 5% (or CPI/CGPA of 0.5 on the scale of 0-10) in the qualifying degree is applicable.

J.1.3. Eligibility of applicants who are in the final phase of getting the qualifying degree

Students who are in the final phase of receiving the above-mentioned qualifying degree and who are likely to graduate before commencement of Autumn 2023-24 semester of IIT Dharwad are also eligible to apply. However, if offered, the admission to those candidates would be provisional. To join an academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining at IIT Dharwad. They need to meet the criteria specified in section above considering an updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission should be used to determine eligibility for application and same to be reported in the online application.

J.1.4. Application Categories and Financial Support

The Department of Electrical Engineering offers admission to PhD program under TA, PA, FA, and EX categories. The details of each application category are given in Section APPLICATION CATEGORIES & FINANCIAL SUPPORT of this document.

Note: The PA, EX, and FA category vacancies are open to all social categories.

J.2. Guidelines for Shortlisted Candidates

J.2.1. Selection Process

All the eligible candidates will be invited for interviews via video conferencing. The interview slot (date and starting time) specific to each candidate will be communicated online at https://www.iitdh.ac.in/academics_phd.php.

Syllabus for the interview is given in Section K.4 of this document.

Selection committee decision is final in all matters including any disciplinary matters/malpractice.

J.3. Research Areas

J.3.1. For TA, FA, and EX categories

The research areas are broadly classified in five streams as described below. **The applicant MUST indicate the choice of the research topics in an order of preference.**

- 1. Microelectronics and VLSI:** Including but not limited to, Analog / Mixed signal / RF Integrated Circuits and Systems, Power management and Energy harvesting circuits etc.
- 2. Electronic Devices:** Including but not limited to Gas sensors, Nano-electronics, GaN-based High-electron mobility transistors (HEMTs), Silicon Carbide (SiC) Power Diodes, Semiconductor Radiation Detectors etc.
- 3. Communication Technologies:** Including but not limited to, physical and medium access control (MAC) layer technologies in Next Generation Wireless Systems (5G and beyond), Internet of Things (IoT), novel multiple access methods like non-orthogonal multiple access (NOMA), massive multi-input multi-output (MIMO) systems, millimeter wave (mmWave) communications, energy harvesting based communications and low-latency communications, Machine Learning (ML) and Blockchain (BC) oriented resource allocation in 6G, Quantum Communication etc.
- 4. Signal Processing and Machine Learning :** Machine learning for signal processing, Deep Learning for signal processing, speech and natural language processing, biomedical signal and image processing and optical character recognition, handwriting recognition and document processing, bioinformatics.
- 5. Power & Energy Systems:** (a) Power systems: Power Systems stability and control; cyber security in smart grid, synchrophasor applications to power systems protection, monitoring and control; microgrid; game theory based incentives for ancillary services, Impact of renewables, battery energy storage and Electric Vehicles on Grid; Smart Grid;
(b) Power Electronics and Drives: Converters for grid-interfacing, modular and multi-level inverters, power converters for Electric Vehicles (Chargers, Drivetrains, Power Supplies); DC Circuit Breakers for medium-voltage applications (renewables, aircraft, shipboard, etc.), Design of Wide-bandgap device based converters (GaN and SiC based topologies); Modeling and Controls for Advanced Power Electronics (soft-switched and resonant converters, distributed control, etc)
- 6. Control and Robotics:** Including but not limited to Control of Robots through Speech Signals, Autonomous Vehicles, Control for Differential Games, Control of Structures etc.

J.3.2 For PA category applications are called in following broad domains

1. Microelectronics and VLSI
2. Power and energy systems
3. Communications
4. Signal processing and Machine learning

Note: Candidates should fill the form only once and clearly indicate preferred area of research. If any candidate fills the form multiple times, only the latest one will be considered.

J.4. Interview Syllabus

All applicants should choose one stream for the interview while submitting the online application form.

Common for all the streams

1. **General aptitude, reasoning and comprehension**
2. **Engineering Mathematics:** Matrix Algebra, Systems of linear equations, Eigenvalues, Eigenvectors, Concepts from integration and differentiation, Fourier Transform and Laplace Transform.

Stream 1: Communication and Signal Processing

1. **Basic Electrical Networks:** KCL, KVL, Node and Mesh analysis, Network theorems etc.
2. **Signals and Systems:**
 - a. **Continuous-time signals:** Fourier series and Fourier transform representations, sampling theorem and applications;
 - b. **Discrete-time signals:** discrete-time Fourier transform (DTFT), DFT, FFT, z-transform and sampling theorem
 - c. **LTI systems:** definition and properties, causality, stability, impulse response, convolution, poles and zeros and frequency response.
 - d. **Random processes:** basics of probability, random variables, CDF, PDF, random processes, mathematical expectation, conditional probability and conditional expectation.
3. **Communication:**
 - a. **Random processes:** Basics of probability, random variables, CDF, PDF, random processes, mathematical expectation, conditional probability and conditional expectation.
 - b. **Digital communications:** Digital modulation schemes, MAP and ML decoding, notions of bandwidth, SNR and BER for digital modulation, fundamentals of error correction codes (e.g.: Linear Block Codes like Hamming code).

Stream 2: Electronic Devices and Mixed signal ASIC Design

1. **Basic Electrical Networks:** KCL, KVL, Node and Mesh analysis, Network theorems etc.
2. **Electronic Devices:** Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.
3. **Analog Circuits:** Basics of Analog circuits.
4. **Digital Systems:** Number systems; Combinatorial circuits; Sequential circuits.

Stream 3: Power and Energy Systems

- 1. Electric Circuits:** KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Three phase circuits, Power and power factor in ac circuits.
- 2. Power Electronics:** characteristics of MOSFET, IGBT and diode, DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters.
- 3. Power Systems:** Per-unit quantities, Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components and fault analysis, Power System Stability, Power System Protection.
- 4. Electrical Machines:** Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformers: connections, parallel operation; Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Synchronous machines: cylindrical and salient pole machines, performance, regulation, starting of synchronous motor, characteristics, P&Q Control.

K. DEPARTMENT OF MATHEMATICS

K.1 Eligibility Criteria

K.1.A. Qualifying degree

M.Sc. Mathematical Science, M. Phil in Mathematical Science (or equivalent degree).

K.1.B. Minimum score required in the qualifying degree

Category	Educational qualification
General/General (EWS)	The eligibility criteria in the qualifying degree is First Class, as specified by the candidate's Institution/University (recognized by GOI). If the Institution/University does not specify the division/class, then one of the following will be considered as the eligibility criteria: (1) A minimum of 60% marks (without round off) in aggregate or (2) a minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).
OBC (NC)	Same as general
SC/ST/PWD	A relaxation of 5% in the qualifying degree is applicable

K.1.C. The candidates who do not have M. Phil. degree must also fulfill ONE of the following additional requirements:

1. Valid GATE score.
2. Junior Research Fellowship in Mathematical Sciences from CSIR, UGC, DST (INSPIRE fellowship), NBHM and other externally funded candidates are encouraged to apply and they are exempted from possessing a valid GATE score.

K.1.D. Eligibility of applicants in the final phase of getting the qualifying degree

Students who are in the final phase of receiving above mentioned qualifying degree and who are likely to graduate before commencement of Spring 2023 semester of IIT Dharwad are also eligible to apply. However, if offered, the admission to those candidates would be provisional. To join an academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining mentioned in the Section A above. They need to meet the criteria specified in section above considering an updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission mentioned in section A should be used to determine eligibility for application and same to be reported in the online application.

K.1.E. Application categories and Financial Support

The Department of Mathematics admits Ph.D. candidates under the full-time research scholarship - Teaching Assistantship (TA) and Fellowship Award (FA).

K.2 Guidelines for shortlisted applicants

K.2.A. Modality of the selection process

Only the short-listed applicants are permitted to participate in the selection process. The

selection process will have two rounds (round 1 and round 2) of tests in the form of interviews or written exams.

- Round 1 is compulsory for everyone.
- Candidates qualifying in round 1, will be invited for round 2.

K.3 Research Topics: Primarily Number theory, Representation theory of groups and related topics. However, other topics relevant to the research interests of faculties may be considered.

K.4 Syllabus

Topics for round 1

Analysis

Elementary set theory, finite, countable and uncountable sets, Real number system as a 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, derivative as a linear transformation, inverse, and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

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. Spectral theorems.

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, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, Calculus of residues. Conformal mappings, Mobius transformation, Riemann zeta function.

Algebra

Fundamental theorem of arithmetic, divisibility in \mathbb{Z} , congruences, Chinese Remainder Theorem, Euler's phi-function. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain, Chinese Remainder Theorem, Finite Fields

Topics for Round 2:

Apart from the topics mentioned above, candidates selected for the second round of interview can be asked questions from some advanced topics related to their area of interest. For example, a candidate interested to pursue research in numerical analysis is expected to have some knowledge in some of the following topics:

1. Field and Galois Theory
2. Rings and Modules
3. Elementary number theory and basic combinatorics

K.5 Focus area of research

Applications are invited for Number theory, Representation theory of groups and related areas. Applications for other areas relevant to the research interests of faculties maybe considered as well.

L. DEPARTMENT OF MECHANICAL MATERIALS AND AEROSPACE ENGINEERING

M.1 Eligibility for Admission

L.1.1. Qualifying Degree

M.Tech./M.E./M.Sc.(Engg.) or equivalent degree in Mechanical Engineering or Materials and Metallurgical Engineering or Aerospace Engineering or equivalent stream

L.1.2. Minimum score in the qualifying degree

For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, the eligibility criteria in the qualifying degree (M.Tech./M.E./M.Sc.(Engg.)):

1. a minimum of 60% marks (without round off) in aggregate, OR,
2. a minimum Cumulative Grade Point Average (CGPA) or Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).

For SC/ST category candidates and differently abled candidates (PwD), a relaxation of 5% (or CPI/CGPA of 0.5 on the scale of 0-10) in the qualifying degree is applicable.

L.1.3. Eligibility of applicants in the final phase of getting the qualifying degree

Students who are in the final phase of receiving above mentioned qualifying degree and who are likely to graduate before commencement of Autumn 2023-24 semester of IIT Dharwad are also eligible to apply. However, if offered, the admission to those candidates would be provisional. To join an academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining mentioned in the Section A above. They need to meet the criteria specified in the section above considering an updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission mentioned in section A should be used to determine eligibility for application and same to be reported in the online application.

L.1.4 Institute Staff

The institute staffs can apply for the PhD if they fulfil the eligibility criteria. It is mandatory to follow the institute's guidelines while applying.

L.2. Modality of selection process

First round: An online interview based on prior experience/MTech Project will be conducted to access the basic understanding related to project and overall Mechanical Engineering. The duration of this will be 10-20 min. You will be given a time-slot window (about 1–3 hours) during which we may connect with you anytime. The interaction must be taken on a desktop or laptop PC with a webcam, a speaker and a microphone. The candidates are not allowed to refer to their books and any online material during the test. The candidates are not permitted to communicate with any person during the test. The candidates may be remotely proctored via the webcam and screen-sharing options.

Second round Interview: Each applicant short-listed in first round will undergo an interview (online), with technical questions, for a duration of approximately 20-30 minutes. Access to

books and online material is not permitted in this round, unless allowed by the interview panel.

You will be given a time-slot window (about 1–3 hours) during which we may connect with you anytime. Your specific time-slot will be communicated to you.

The interactions in the above rounds may be recorded by IIT Dharwad. Any suspicious activity indicating cheating during the first or second rounds of selection will be grounds for disqualification of candidature

L.3. Dos and Don'ts

Dos:

- We recommend to try out a mock call session before the actual interview to ensure the audio-video set up is ready.
- Please plan to have at least 2GB of data with you before the meeting. Also, try to locate yourself in a place with good internet speed (at least 1.5Mbps) for a good quality video interaction. Laptops/tablets are preferred for video conferencing.
- Have paper and pen or pencil calculators handy for any rough work.
- Keeping a glass of water ready may be a good idea.
- Ensure that equipment is charged to avoid power issues.
- Ensure that the place from where you are attending the interview is conducive for effective interaction online.
- Best Practices while in online meetings:
- Sign in to the online client (Google Meet App/Desktop) 10-15 minutes ahead of scheduled meeting time and stay signed in
- Turn your camera on and have your camera at the eye level
- Stay muted unless you're talking to reduce background noise
- Make sure you sit in a well-lit and quiet place
- Be mindful of what's going on behind you. Think about having a solid wall/nice curtain behind you or turning on the virtual background (if available).

Don'ts:

- Do not record interviews in any form. Any such act will be considered as violation of the pledge you signed online and may invite punitive action from IIT Dharwad
- Avoid windy noisy surroundings during interview
- Do not record interviews in any form. Any such act will be considered as violation of the pledge you signed online and may invite punitive action from IIT Dharwad.
- Do not ask about the schedule of the results. It is better to use interview time for other better inquiries as the results will be declared online as soon as possible.
- Do not leave your place in front of the camera for the entire duration of the interview.
- Prepare yourself to avoid any kind of break during interview, including restroom-break
- Do not have anyone else around you. Any interaction with someone else other than the interview panel during the interview will be considered as a suspicious activity.

Note - For any matter related to the selection process, the decision of the selection committee would be considered as the final decision

L.4. Focus area of research

Department of MMAE, IIT Dharwad is looking for PhD students in the following broad research areas. Applicant should be interested in at least one of the following research areas.

- **Thermal and Fluids Stream:** Atomization and sprays, Computational fluid dynamics, Fire dynamics, Multiphase flows, Turbomachinery aerodynamics, Combustion and Thermoacoustics, Dynamics of thin films
- **Design Stream:** Fracture mechanics, Finite Element Analysis, Biomechanics, Multibody kinematics and dynamics, Tribology, Computer vision and augmented reality, Reduced order modeling
- **Manufacturing and Materials Stream:** Metal forming, Additive manufacturing, Computational Materials Design, Physical and Mechanical Metallurgy, Digital Twins, Structural Materials for Aerospace and Automobile

For more details on the tentative PhD research topics, please click on the following link

[Tentative PhD topics MMAE, IIT Dharwad](#)

L.5. Syllabus – Common for all streams

L.5.1. 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.

L.5.2. Analytical reasoning

Verbal reasoning: reading comprehension, drawing inferences based on multiple facts stated in short paragraphs.

Non-verbal reasoning: inductive, logical, abstract, diagrammatic and spatial reasoning.

L.6. Syllabus – Specific to the selected stream

L.6.1. Design Stream

Engineering Graphics: Orthographic projections of lines, planes and solids, true length and true angle, sections of solids and intersections of solids, solid modeling.

Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; 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.

Control Systems: Automatic Control, Use of Feedback, Automatic Assembly and Robots, Mechatronic Systems, Control System Design.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

L.6.2. Fluid-Thermal Stream

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes and bends, flow in convergent-divergent channels, vorticity and stream-functions, elementary Computational Fluid Dynamics, finite-difference approximation to the first and second order partial derivatives.

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, behavior 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, Steam and gas turbines, axial flow compressors.

L.6.3. Manufacturing and Materials Stream

Engineering Materials: Structure and properties of engineering materials, Crystal Imperfections, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Dislocation theory, Strengthening mechanisms, fracture mechanics, fractography, ductile to brittle transition. Fatigue, Mechanisms of high temperature deformation and failure, X-ray Diffraction,

Metal Forming: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes, Plastic deformation by slip and twinning.

Sheet Metal working: Die and punch clearances, blanking, piercing, punching, bending, cup drawing, coining, embossing, incremental forming.

Metal Casting: Different types of castings, solidification and cooling, Pattern materials, allowances, types of pattern, cores, element of gating systems, types of gates, riser design considerations, casting defects.

Polymers and Composites: Thermoplastics, thermosets, elastomers and composites, gradient material and related processes.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools, tool path generation, additive manufacturing

Appendix A: Sponsorship Certificate for Ph.D. External Registration (EX)

(To be typed on letterhead of the Sponsoring Organization)

Name of the applicant:

Name of the sponsoring organization:

Address:

Present Designation of the applicant:

Present status of the applicant: (Permanent/Semi-permanent/Temporary)

Division where research work is proposed to be done:

Name of supervisor from the sponsoring organization:

(Bio-data of supervisor to be enclosed giving details of designation, qualification, research experience etc.)

Details of facilities relevant to the research problem which will be made available to the candidate by the organization.

Statement of proposed Co-supervisor (external)

If Shri / Kum. / Smt. _____

is registered for the doctorate degree, I, _____

, agree to act as his/ her research Co-supervisor along with the research Supervisor from IIT Dharwad.

Date:

Signature of proposed Co-supervisor (external)

=====*****=====

Statement of sponsoring authority

If Shri. /Kum. / Smt. _____

is admitted to the Ph.D. programme, we shall allow him/ her to undergo the programme of studies at IIT Dharwad.

Further, we shall fully relieve him/her from normal duties to complete the course work requirement (and qualifier examination, if applicable) at IIT Dharwad.

During the period of Doctoral programme, the candidate will be permitted to carry out his / her research work at our laboratories / organization and will be given the required facilities.

We also give our consent to Shri. /Kum. / Smt./Dr. _____

of our organization to be the Co-supervisor (external) of the Ph.D. thesis, along with a faculty member of IIT Dharwad as the Supervisor.

Date:

Signature and Seal of the Sponsoring Authority

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