

INDIAN INSTITUTE OF TECHNOLOGY DHARWAD



॥ सा विद्या या विमुक्तये ॥

भारतीय प्रौद्योगिकी संस्थान धारवाड
Indian Institute of Technology Dharwad

Information Brochure

(For Indian National applicants)

Ph.D. Admissions

Autumn Semester 2021-22

Contents

A.	SCHEDULE OF Ph.D. ADMISSION (Tentative).....	3
B.	APPLICATION CATEGORIES & FINANCIAL SUPPORT.....	3
B.1	Teaching Assistantship (TA).....	3
B.2	Fellowship Awardee (FA).....	4
B.2.a	Description – FA.....	4
B.2.b	PMRF: A brief Note on Prime Minister’s Research Fellowship.....	4
B.3	Project Assistantship (PA)	4
B.4	Externally sponsored Ph.D. (EX).....	4
C.	GENERAL GUIDELINES for APPLYING ONLINE	5
D.	INFORMATION PERTAINING TO HOSTELS	7
E.	FEES, DEPOSITS & HOSTEL RENT	8
F.	DEPARTMENT OF MECHANICAL ENGINEERING	9
F.1	Eligibility for Admission	9
F.1.a	Qualifying Degree.....	9
F.1.b	Minimum score in the qualifying degree	9
F.1.c	Eligibility of applicants in the final phase of getting the qualifying degree	9
F.2	Guidelines for shortlisted candidates	9
F.3	Modality of selection process.....	9
F.4	Dos and Don’ts.....	10
F.5	Focus area of research.....	11
F.5.a	Experimental Fluid Mechanics with a focus on Multiphase flows	11
F.5.b	Fluid mechanics and combustion dynamics of laminar/turbulent combustion systems.....	11
F.5.c	Biomechanical analysis and biomedical device design.....	11
F.5.d	Constitutive modelling for anisotropic elastic-plastic deformation and numerical analysis of metal forming processes.....	12
F.6	Syllabus – Common for all streams	12
F.6.a	Engineering Mathematics.....	12
F.6.b	Analytical reasoning.....	12
F.7	Syllabus – Specific to the selected stream	13
F.7.a	Design Stream.....	13
F.7.b	Fluid-Thermal Stream	13
F.7.c	Manufacturing stream	14
G.	APPENDIX A.....	15

A. SCHEDULE OF Ph.D. ADMISSION (Tentative)

Serial No.	Description	Relevant dates
1	Last Date to apply online	10-June-2021
2	Announcement of shortlist and Online Interview Schedule (tentatively)	15-June-2021
3	Online Interview ends	02-July-2021
4	Declaration of final list of selected candidates	14-July-2021
5	Admission for waitlisted candidates starts	22-July-2021
6	Admission for waitlisted candidates ends	23- July-2021

All potential candidates are requested to visit institute website regularly for updated information about the schedule, especially in context on ongoing Coronavirus (COVID-19) related developments. **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 under the full time research scholarship or Teaching Assistantship (TA) and part-time externally sponsored research scholars. However, **each department may not have opening in all the following modes of support.** More details can be found in the Appendix section corresponding to the department.

B.1 Teaching Assistantship (TA)

Funded by MHRD, 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 MHRD 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 submission, 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. To get the Teaching Assistantship, the students concerned 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 performance.
4. As per MHRD 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.

B.2 Fellowship Awardee (FA)

B.2.a Description – FA

The financial support under this category is provided by various Govt. / Semi Govt. schemes (CSIR, UGC, DAE, DST, DBT, NBHM, etc.) and some other organizations.

A valid Junior Research fellowship (JRF) award letter from the Govt. / Semi Govt. agencies (e.g. CSIR / UGC / DAE / DST / DBT / NBHM / (confirmed) DST INSPIRE, etc.) is required for the execution of this fellowship.

The amount and duration of the fellowship 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.b 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. On the day of selection process, 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, meeting 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.

Based on the information provided by the applicants a short-list of candidates called for the selection process will be declared on the Institute website on the date specified in the schedule. Only the short-listed 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 filing 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.

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
3. The procedure to pay the application fee is made available on the website and application form.
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:

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 is Non-Refundable.**

8. Applicants may find it convenient to keep following information handy while filling the application form online (whichever relevant):

- Skype Id / 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)
- Proof of application fee payment (pdf file)
- List of fellowship/ awards
- Publications
- 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. Check your emails regularly for any communication from the institute regarding the selection process.

11. **Keep checking institute website regularly for updates regarding the selection process. Shortlisted candidates list will be uploaded on the institute website as per the schedule given above.**

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.

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 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 bicycle is 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 fee applicable for admission to Ph.D. programmes (as collected during the Autumn Semester 2020-21) is provided below for reference purpose only:

S. No.	Fee Description	Amount (in INR) General/OBC/EWS	Amount (in INR) SC/ST/PwD
A. One-time payment at the time of admission			
1	Admission fee	2,200.00	2,200.00
2	Thesis fee	2500.00	2500.00
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	2500.00	2500.00
7	Identity card	500.00	500.00
	Sub-total (A)	9,600.00	9,600.00
B. Per semester fee			
1^	Tuition Fee-Statutory fee	2500.00	00.00
2	Examination fee	1,000.00	1,000.00
3	Registration fee	750.00	750.00
4*	Gymkhana fee	525.00	525.00
5	Student benevolent fund	500.00	500.00
6*	Medical fee	450.00	450.00
7	Hostel room rent	-	-
8	Electricity & water charges	-	-
9	Hostel establishment charges	3,000.00	3,000.00
10	Mess establishment charges	1,550.00	1,550.00
	Sub-total (B)	10,275.00	7,775.00
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	3000.00
GRAND TOTAL FEE (A+B+C)		22,875.00	20,375.00

F. DEPARTMENT OF MECHANICAL ENGINEERING

F.1 Eligibility for Admission

F.1.a Qualifying Degree

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

F.1.b 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.):

- 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.c 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 2021 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 F.1.b 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.

F.2 Guidelines for shortlisted candidates

The precise guidelines related to the selection process, documents required, etc. will be intimated at the time of announcement of shortlisted candidates on the Institute Website.

F.3 Modality of selection process

Only the short-listed and confirmed applicants are permitted to participate in the selection process. The selection process may consist of online screening tests, written tests and/or interviews. Candidates will be offered a PhD position based on their performances as mentioned above. Selection process of first round of interviews via an online mode. After the first round, a list of shortlisted candidates will be displayed on the website. The shortlisted candidates will be asked to attend the second round of interview via video conferencing.

First round: In the first round there will not be any online written test. The candidate may have to present their masters thesis work and the interview may be conducted based on the Master degree specialization subjects and prior work experience. The duration of the presentation and interview

will be between 20 min to 30 min. The candidates are not permitted to communicate with any person during the interview. The candidates may be remotely proctored via the webcam and screen-sharing options.

Second round Interview: Each applicant will undergo an interview, with mostly technical questions, for a duration of approximately 45 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.

F.4 Dos and Don'ts

Dos:

- 1) Please participate in a mock call session before the actual interview to ensure the audio-video set up is ready. Example, a pre-lunch slot mock call starts at 9:00 am.
- 2) 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.
- 3) Have paper and pen or pencil calculators handy for any rough work.
- 4) Keeping a glass of water ready may be a good idea.
- 5) Ensure that equipment is charged to avoid power issues.
- 6) Ensure that the place from where you are attending the interview is conducive for effective interaction online.
- 7) 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:

- a) Avoid windy noisy surroundings during interview
- b) 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.
- c) 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.

- d) Do not leave your place in front of the camera for the entire duration of the interview.
- e) Prepare yourself to avoid any kind of break during interview, including restroom-break
- f) 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.

F.5 Focus area of research

Following topics are floated in the Department of Mechanical Engineering for the PhD program this semester. Applicants have to choose at least one of these topics and fill in the application form.

Thermal Stream: F.5.a, F.5.b

Design Stream: F.5.c

Manufacturing Stream: F.5.d

F.5.a Experimental Fluid Mechanics with a focus on Multiphase flows

Broadly experimental investigation in the area of Fluid Mechanics with a focus on Multiphase Flows. Specific topics may include the study of liquid sprays and atomization process in detail - involving various visualization techniques, also using laser diagnostics, to better understand the underlying physics. The instabilities that dictate the various processes shall also be analysed. Computational work shall also be carried out to fill the gaps in understanding left by the experimental data and also to build reliable predictive models capturing the phenomena.

F.5.b Fluid mechanics and combustion dynamics of laminar/turbulent combustion systems

The research pertains to the fundamental and application-based investigation of combustion dynamics, thermoacoustic instabilities, hydrodynamic instabilities, and flame stabilization problems that are of interest to the aerospace community. It is expected to analyse these phenomena through both numerical projects and experiments in laminar and turbulent combustion systems. The complex interactions of fluid mechanics, acoustics and combustion will be studied from complex networks and synchronization framework to develop and test new methods of controlling combustion instabilities.

F.5.c Biomechanical analysis and biomedical device design

Leveraging the artificial intelligence techniques especially in using computer vision to create high fidelity 3D geometrical models of the complex anatomical shapes and design of biomedical devices. This work will use the sophisticated non-linear computational mechanics simulations to optimize design and performance.

F.5.d Constitutive modelling for anisotropic elastic-plastic deformation and numerical analysis of metal forming processes

The focus area of this research is to develop constitutive models for isotropic/anisotropic elastic-plastic deformation of sheet metals and using the same in numerical analysis of metal forming processes. The candidate should have a motivation to perform experimental, analytical and numerical analysis of plastic deformation in metal forming processes. Knowledge of continuum mechanics and numerical implementation of the same will be an added advantage. The challenge of this research is to develop suitable, accurate and efficient constitutive models, which are tailored to new materials, yet simple enough to allow time efficient numerical simulations. Another challenge is to develop optimization methods to identify and optimize suitable constitutive parameters.

F.6 Syllabus – Common for all streams

F.6.a 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.

F.6.b 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.

F.7 Syllabus – Specific to the selected stream

F.7.a 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.

F.7.b 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.

F.7.c Manufacturing stream

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

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.

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.

Metal Joining and Welding: Fusion and solid-state welding, brazing, soldering, manual metal arc, submerged arc, Gas Metal Arc Welding (GMAW), Tungsten Inert Gas (TIG), resistance welding, Additive Manufacturing (rapid prototyping), 3D Printing.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

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

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

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

G. APPENDIX A

Sponsorship Certificate for PhD 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:

(CV of supervisor is requested to be produced on the day of selection 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 PhD 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 PhD 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 residential course work requirement (and qualifier examination, if applicable) at IIT Dharwad.

During the period of PhD studies, 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 _____ of our organization to be the Co-supervisor (external) of the PhD thesis, along with a faculty member of IIT Dharwad as the Supervisor.

Date:

Signature and Seal of the Sponsoring Authority

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