

# DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering Govt. of NCT of Delhi)

ISO 9001:2015 Certified

ACCREDITED with 'A' Grade (CGPA 3.22 out of 4.0) by NAAC

Ph.D. Admission under  
AICTE Doctoral Fellowship  
(ADF)

2022-23

Information Brochure

## **About Delhi Technological University**

Delhi Technological University (Formerly known as Delhi College of Engineering) is one of the most well-known engineering institutions of India, with over 80 years of glorious tradition behind it. A non-affiliating, teaching and research University, DTU is poised to create an environment of synergetic partnership between academia and industry. It aims to cause a major departure from the conventional system of education and research and aspires to imbibe a culture of scientific research in its technology disciplines and technology temper in its scientific research and education by providing a seamless environment for integration of science and engineering. The University also endeavors to provide the thrill of a corporate R&D environment with a planned focus on industrially relevant projects and technology incubation. DTU has consistently been ranked among the top engineering institutions of the country in reputed surveys.

Currently the University offers 17 Full time UG Programmes, 25 Full Time and Part Time M.Tech. Programmes, 05 Full Time MBA programmes, 01 Executive MBA Weekend programme, 04 M.Sc. programmes, M.Des. Programme and Ph.D. programme in various disciplines. Further, teachers from various engineering colleges also join University for the doctoral programmes under Quality Improvement Programme (QIP). The University on an average admits 3200 candidates for the Undergraduate Programmes and about 1200 candidates for different Postgraduate programmes and Doctoral programmes every year.

The University is located in about 163.87 acres of natural flora and fauna, DTU is one of the greenest residential campuses in the country. It has added the dimension of research and caused innovations in plenty, which has received high national and international acclaim. The University has the desired autonomy to excel and shape itself as a world class Technological University.

### **1. RESEARCH FACILITIES AT DTU**

All the academic departments of the university have well equipped research laboratories and workshop facilities. In addition, there are a number of central facilities such as Central Workshop, Solar Energy Centre, Central Instrumentation, Centres for Advanced Studies & Research in Automotive Engineering, TIFAC-CORE, Central Library and Computer Centre. The Central Library has more than 200,000 books, a large collection of back volumes of periodicals, standard specifications and other literature. It subscribes more than 39,924 current journals in Science, Engineering, Humanities and Social Sciences as e-resources. DTU has a well-equipped centralized Computer Centre which provides state of art high-end networked computing facilities to students and staff. The University has many research collaborations with leading universities and Institutes in Korea, Singapore, France, Florida USA, Africa and China. As part of these collaborations, the students get opportunities to carry out joint research projects with faculty and students from these institutions. The location of DTU in close proximity to several leading R&D Centres namely NPL, INMAS, FICCI, CSIR, etc. and other major industrial

establishments offers excellent opportunities to interact with them and plan research programmes and projects in collaboration with them.

## 1. AICTE DOCTORAL FELLOWSHIP (ADF)

AICTE has approved 08 nos. of Doctoral Fellowship seats to the Delhi Technological University for the Academic Year 2022-23. Which is distributed among the following Engineering Departments:

- (1) Electrical Engineering
- (2) Electronics & Communication Engineering
- (3) Mechanical Engineering

**a) OBJECTIVES:** - The objectives of the ADF scheme are:

- To promote research culture in AICTE approved Institutions.
- To promote collaborative research between Institute and Industries leading to start-ups.
- To nurture talents for technical research

**b) BROAD AREAS OF RESEARCH:**

Some of the broad thrust areas (but not limited) for the research are as follows: -

- Green Technologies
- Big Data, Machine Learning & Data Sciences
- Block Chain
- Artificial Intelligence
- Energy Production and Storage
- Electronics & Photonics
- Nuclear Engineering and Allied Technologies
- Robotics and Mechatronics
- Augmented Reality (AR)/ Virtual Reality (VR)
- Energy Efficiency, Renewable and sustainable Energy
- Electric and Hybrid Mobility
- Smart Cities, Housing and Transportation
- Internet of Things (IoT)
- 3D Printing
- Quantum Computing
- Smart Technologies for Agriculture and Food Industry
- Water purification, conservation and management
- Public Policy
- Social & Organizational Psychology & Behaviour
- Cyber Security

**For more details, please see the AICTE guidelines which is uploaded on DTU Website [www.dtu.ac.in](http://www.dtu.ac.in) on dated 29.09.2022**

## 2. ADMISSION ELIGIBILITY

Academic Department	Disciplines Offered	Discipline Specific Eligibility Criteria
Electrical Engineering	Electrical Engineering	Master's degree in Engineering / Technology in relevant discipline or equivalent and Bachelor's degree in Engineering / Technology in relevant discipline or equivalent with a minimum 70% / CGPA 7.5. on the scale of 10 or equivalent.
Electronics & Communication Engineering	Electronics & Communication Engineering	Master's degree in Engineering/Technology in relevant discipline or equivalent and Bachelor's degree in Engineering/Technology in relevant discipline with a minimum 70% / CGPA 7.5. on the scale of 10 or equivalent.
Mechanical Engineering	Mechanical Engineering	Master's degree in Engineering/Technology or a Master's degree by Research in Engineering/Technology in Mechanical with specialization in Thermal/ Production / Design / Industrial Engineering and Bachelor's degree in Engineering / Technology in Mechanical / Production / Production and Industrial / Mechanical and Automation / Automobile Engineering with a minimum 70% / CGPA 7.5. on the scale of 10 or equivalent..

## 3. ELIGIBILITY CRITERIA FOR THE AWARD OF ADF FELLOWSHIP: -

The detailed criteria for the award of fellowship are as follows:

- a) The candidate must have secured the minimum percentage of educational qualification prescribed for eligibility as in Under Graduate and Post Graduate be 70% (69.5 % and above) for General/OBC candidates, whereas for SC/ST/Physically Handicapped (PH) be 65% (64.5 % and above). In the absence of percentage, the candidate must have secured minimum cumulative grade point average (CGPA) of 7.5 on the scale of 10 or equivalent at Bachelors and Masters whereas for SC/ST/Physically Handicapped (PH) it is 7.0 on the scale of 10. In addition to above, the candidate should have qualified GATE/ NET during the last 5 years.
  - The students serving as faculty under TEQIP scheme can also be given preference for admission in this programme.
  - The minimum percentage criterion for the Indian students' qualified Bachelor/Master's degree from Foreign Universities shall be waived off but student will have to qualify GATE exam during last 5 years.
- b) The candidate should be less than 30 years of age as on date of admission in respective University. However, age relaxation of 5 years would be applicable to candidates belonging to SC/ ST/Women/Physically challenged category.
- c) AICTE supported ADF fellowship is not admissible to left out students, who have already availed the ADF fellowship from AICTE, on his/her taking admission for the 2nd time in any other University/Institutes.

#### 4. SELECTION PROCEDURE

1. The short listing of applications possessing the minimum educational qualifications, for the purpose of screening test & interview will be done by respective departments in consultation with the Ph.D. Coordinator nominated by the Vice-Chancellor. The entrance test will be of 90 minutes duration comprising of 60 multiple choice questions. The cut off for the same will be decided by the University.
2. The mode of conducting the Admission/ Entrance Test shall be **Computer Based Test at DTU Campus.**
3. The Departmental Research Committee (DRC) of the respective department shall decide the cut off for the screening test for short listing the candidates for the interview in consultation with Dean PG. Based on the academic record and the performance of the candidates in the interview, the DRC will recommend to the Dean PG the names of candidates.
4. All the shortlisted candidates on the basis of screening test are required to come along with 7 to 8 slides of power point presentation on the topic of their interest during the interview.

#### 5. Seat Matrix

Vacant Seats for Full Time Ph.D. Programme with AICTE Doctoral Fellowship (ADF) for the Academic Year 2022-23						
Name of the Department	Code of the Department	Gen	OBC	SC	ST	Total
Electronics & Communication Engineering	ECE	1	1	1	-	3
Electrical Engineering	EE	1	1	-	1	3
Mechanical Engineering	ME	2	-	-	-	2
<b>Total</b>						<b>8</b>

#### 6. RESERVATION OF SEATS

Reservation of seats with fellowships for applicants in each of the categories of the research scholars shall be in accordance with the policies of Govt. of NCT of Delhi. The percentage of reservations for various categories and relaxation in minimum eligibility conditions as applicable for the academic session 2022-23 is tabulated below.

S. No.	Category	Seats reserved	Relaxation in Essential Qualification
1.	Scheduled Caste (SC)	15%	5%
2.	Scheduled Tribes (ST)	7.5%	5%
3.	OBC	27%	-
4.	Person with Disability	5% (Horizontal)	5%
5.	EWS	10%	-

## 7. APPLICATION PROCESS

For admission to Ph.D. programmes 2022 under ADF scheme, all candidates need to register and fill the application ONLINE only by accessing [www.dtu.ac.in](http://www.dtu.ac.in) from October 1<sup>st</sup>, 2022 to October 24<sup>th</sup>, 2022. The application process is completed only when a print out of the filled ONLINE application form is taken after paying online the registration fee. The candidate must bring a duly signed copy of the same along with two good quality photo (same as uploaded on online application form) affixed in the appropriate place on the form on the day of interview.

Candidates are requested to ensure that they must fulfil all such requirements before filling and applying for such programmes as their choices. Incomplete application due to any reason is liable for rejection by the University. In this regard, no communication will be entertained.

## 8. Application Fee

The registration fee of Rs.1500/- for all categories is to be paid online through credit/debit card /net banking at the time of registration and choice filling. The registration shall not be complete without the payment of registration fee which is non-refundable and would not be adjusted towards any other fee. A convenience charge (online transaction) will be extra as per banking gateway on every online registration fee payment. **If a candidate wishes to apply for admission in a programme offered by different departments then he/she will have to register separately in that department by paying separate online registration fee.**

## 9. Fee and Documents to be submitted

The selected candidates will be required to pay the admission fee as per the details given below:

S. No.	Particulars	Annual Fee	
		At the time of Admission	2 <sup>nd</sup> year onwards
1.	Tuition Fee	12000	6000
2.	Non Govt. Component		
2.1.	Student Welfare Fee (Co-curricular activities, Training & placement, Extra Curricular Activities, Annual Gathering, Student welfare, Institutional Development, outsourcing, conference, seminar, workshop, innovative projects, skill development activities and, Misc. Expenditure on Unspecified Items)	6000	4500
2.2.	Facilities & Services Charges (Research initiatives, training programmes, Awards, automation, facilities, entrepreneurship activities and any misc. expenditure on unspecified items)	2500	1000
2.3.	Economically weaker section fund	1000	1000
2.4.	Examination fee (Examination Infrastructure strengthening, expenditure on examination activities, confidential printing etc.	7000	-
2.5.	Premium amount for mediclaim of student (per-annum)	700	700
	<b>GRAND TOTAL</b>	<b>29200</b>	<b>13200</b>

## Withdrawal/Refund Policy

The University follows the following policy for the remittance and refund of fee, if a student chooses to withdraw from programme of study in which he / she is enrolled:

S. No.	Percentage of Refund of aggregate fee	Point of Time when Application for Withdrawal of admission is received
1.	100%	Application for withdrawal of admission received up to 01.11.2022
2.	80%	Application for withdrawal of admission received from 02.11.2022 to 07.11.2022
3.	50%	Application for withdrawal of admission received from 08.11.2022 to 12.11.2022
4.	NIL	Application for withdrawal of admission received after 12.11.2022

Note: *Last date of admission is 31.10.2022. Any change will be notified separately on DTU website. Candidates are advised to visit DTU website [www.dtu.ac.in](http://www.dtu.ac.in) regularly for updation.*

### Original Documents to be submitted for verification at the time of Admission

- Printed copy of online registration application
- All the semesters Mark sheet/grade card / provisional / degree certificates beginning from first degree towards proof of qualification.
- All the candidates will be required to produce the proof of having passed the qualifying degree with the required percentage of marks or CGPA latest by **November 07, 2022**, failing which their admission shall be cancelled.
- Caste Certificate in the case of SC/ST/ OBC-NCL candidates issued by the respective State Government as per format Annexed at 1.
- Date of Birth Proof
- Two passport sized recent photographs
- Copy of Cancelled Cheque
- Copy of Adhaar Card

### IMPORTANT INSTRUCTIONS

- The candidates are advised to read each and every instruction given in this Information Brochure very carefully before applying Online.
- All entries should be carefully made while applying online. DTU will not be responsible for wrong entries. Candidates shall be sole responsible for the correctness and authenticity of the information / documents provided in the online application.
- Online application found incomplete in any form will be summarily rejected. No-correspondence / communication will be entertained in this regard.

4. The last date for submission of online application shall not be extended. Accordingly, no request shall be entertained for accepting the application after the last date. Therefore, candidates are advised to submit their application well in advance and not to wait for the last moment.
5. The University has the right to cancel, at any stage, the admission for the candidate who is found admitted to a course to which he/she is not entitled, being unqualified or ineligible in accordance with the statues and regulations in force.
6. The list of the shortlisted candidates for screening test, interview and finally selected for admissions to Ph.D. programme will be displayed on the DTU website: [www.dtu.ac.in](http://www.dtu.ac.in)
7. Candidates have to bring a valid photo identity card for the purpose of written test along with the printed application form.
8. There is no need to send any part of application form to DTU by post.
9. Incomplete applications are likely to be rejected.
10. No separate call letter will be dispatched.
11. The candidates are advised to make their own arrangements for travelling and lodging accordingly. They must come prepared for admission (in case they are selected) as per the schedule.
12. Candidate should check the University website for results / important announcements.
13. Candidates called for the interview should bring with them (i) Photo ID Card, (ii) Printed copy of the application submitted online, (iii) Thesis / dissertation / report / publications (iv) copy of certificates and mark-sheets.
14. The candidates may contact faculty members/Head of the concerned academic departments for selecting their area of research work.

## **9. Information about Academic Departments**

### **(1) Department of Electronics and Communication Engineering**

The vision of the department is to foster education, innovation and research in the frontline areas of Electronics and Communication Engineering for the sustainable growth of nation and service to the mankind. The department offers UG and PG programmes with annual intake of 240 students in the B. Tech programme in Electronics and Communication Engineering and the PG Programmes include M. Tech. in VLSI Design and Embedded Systems; Signal Processing and Digital Design; and Microwave and Optical Communication. The Department has focused attention on quality research and offers Ph. D. Programmes in the area of Electronics and Communication namely VLSI, DSP, Image Processing, Micro strip antenna design, Sensor Networks, Analog and digital system design. The Department also has active MoUs with academic institutions, research labs and the industrial sector to ensure that the students and faculty can get ample opportunities to work on real-world problems in collaboration through these MoUs.



**Research Areas:** VLSI Design, Computer Vision, Pattern Recognition, Object Tracking, Image Processing, Human Computer Interaction, Wireless Sensor Network, Microwave Engineering, Antenna Design, Digital Signal Processing, Wireless Communication, RF Devices, Nanoelectronics, Network Security, and Cloud Computing, Optical Communication, R F Circuit Design.

## **2. Department of Electrical Engineering**

The goal of the department is to provide quality education at undergraduate and post graduate levels and undertake cutting edge research in various areas of Electrical Engineering. The department also aims to develop active collaboration with various industries in the power sector. The department has an annual intake of 300 and 60 students in the B.Tech programmes in Electrical Engineering and B.Tech (Evening), respectively. At the post graduate level, the department is offering three M.Tech programmes in Control and Instrumentation, Power Systems and Power Electronics and Systems. In addition to the above the department offers regular Ph.D. programmes in various areas of specialization in Electrical Engineering. The department is involved in carrying out several sponsored R&D projects funded by national agencies like AICTE, DST etc. The department is establishing a new Centre of Excellence for Electrical Vehicle and Related Technologies (COE for EVRT) which is funded jointly by Govt. of NCT of Delhi and Delhi Technological University.

**Research Areas:** Power system optimization, AI Techniques, Modelling & Analysis of Electrical machines, Power Electronics & Drives, Intelligent control of nonlinear systems, FACTS, SSR, Voltage stability, Power quality improvement, Grid integration, Micro grid, Smart grid, Analog Signal processing (Linear and Nonlinear), Power system & control, System Engineering, Power System Analysis, Power electronics, Renewable energy, HVDC, Power systems restructuring, AI in Electricity market forecasting, Wind energy forecasting, Embedded system, Information security, Design of power supply, Electric traction systems, Energy conversion, IOT enabled electrical system, Charging infrastructure for EVs, Battery management system (BMS), Electric drives & control, EV retrofitting.

## **3. Department of Mechanical Engineering**

The Department of Mechanical Engineering also offers undergraduate and Postgraduate courses with specialization in

- a) Thermal Engineering
- b) Production Engineering.
- c) Industrial Engineering and Management
- d) Computer Aided Analysis and Design
- e) Energy Systems and Management

Ph. D Programmes in all fields of Mechanical Engineering are also offered. The department possesses modern laboratories equipped with latest experimental set-ups and research

facilities for instrumentation, experimental stress analysis, strength of materials, fluid mechanics, tic, engines, automotive engineering, robotics, heat transfer, solar energy, flexible manufacturing system, computational fluid dynamics supported by Software like view-flex, CAD-CAM and I.e. engine design. Cad lab has Softwares like NX-LAD, NXCAM, AUTOCAD Inventor, Catia, Techomatix, Abus, ladino, NX-Narran, Hyper mesh, hyper works, MDADAMS, Dynaform etc. The department has many research projects which are sponsored by different government organizations.

**Research Areas:** Turbo Machinery, Fluid Mechanics, Power Plant Engineering, Refrigeration and Air conditioning, Computational Fluid Dynamics, Solar Energy, Bio Fuels, Power Plant, Industrial Engineering & Supply Chain Management, Robotics, CAD/CAM, Welding, Production Engineering, System Dynamics, Structural Vibration, Modeling & Simulation, Automation, Advanced Manufacturing Process, Human Factor Engineering, Quality Engineering.

### **Syllabus for Screening Test for Ph.D. Admissions Academic Year 2022-23:**

#### **1. Department of Electrical Engineering**

##### **Section 1: Electric Circuits**

Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, passive filters, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Two-port networks, Three phase circuits, Power and power factor in ac circuits.

##### **Section 2: Electromagnetic Fields**

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

##### **Section 3: Signals and Systems**

Representation of continuous and discretetime signals, Shifting and scaling operations, Linear Time Invariant and Causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Applications of Fourier Transform, Laplace Transform and z-Transform.

##### **Section 4: Electrical Machines**

Single phase transformer; equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformer; connections, parallel operation; Auto-transformer, Electron mechanical energy conversion principles, DC machines; separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three

phase induction motors, Principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Operating principle of single phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.

### **Section 5: Power systems**

Power generation concepts, ac and dc transmission concepts, Models and performance of transmission lines and cables, Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss-Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

### **Section 6: Control Systems**

Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signals flow graphs, Transient and Steady-state analysis of linear time invariant systems, Routh-Hurwitz and Nyquist criteria, Bode plots Root loci, Stability analysis, Lag, Lead and Lead-Lag compensators; P, PL and PID controllers; State space model, State transition matrix.

### **Section 7: Electrical and Electronic Measurements**

Bridges and potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multimeters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

### **Section 8: Analog and Digital Electronics**

Characteristics of diodes, BJT, MOSFET; simple diode circuits clipping, clamping, rectifiers; Amplifiers; Biasing, Equivalent circuit and Frequency response; Operational amplifiers; Characteristics and applications, Combinational and Sequential logic circuits, multiplexer, DE multiplexer, 8085 microprocessors; Architecture, programming and Interfacing.

### **Section 9: Power Electronics**

Characteristics of semiconductor power devices; Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion; Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.

## 2. Department of Electronics and Communication Engineering

### Engineering Mathematics:

Calculus: Sequences and Series, differential calculus, integral calculus, vector calculus. Basics and ordinary differential equation (ODE) and partial differential equation (PDE), Fourier Series Linear Algebra: Determinants and matrices, Cayley-Hamilton Theorem, Hermitian, skew Hermitian, unitary matrices, eigen values, eigen vectors. Vector space, basis, linear dependence and independence, Numerical Analysis: Numerical solution of algebraic equations using Gauss elimination and Gauss-Siedel methods, Gauss Jordan, numerical solution of ordinary differential equations using Picard, Euler method. Interpolation. Probability and Statistics: mean, mode, median and standard deviation, Probability space, conditional probability, Baye's theorem, uniform, binomial, poisson, normal and exponential distribution.

### Networks, Signals and Systems

Network solution methods; nodal and mesh analysis; Network theorems; superposition, Thevenin and Norton's, maximum power transfer; Wye-Delta transformation; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters; driving point and transfer functions; State equations for networks. Continuous-time signals; Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals; discretetime Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems; definition and properties causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

### Signals and Image Processing

**Image transforms-** Short term Fourier transform, Wavelet transform, DWT. Image Enhancement techniques- Spatial domain relationship between pixels- basic grey level transformations, Histogram processing, smoothing spatial filters, sharpening spatial filters.

**Frequency domain-** smoothing frequency domain filters-sharpening frequency domain filters, homographic filtering.

**Segmentation techniques-** Thresholding based, cluster analysis, region growing.

**Morphological Operation-** Dilation, Erosion. Histogram and Histogram equalization. Feature Extraction Techniques. Image Restoration-Weiner filter, Image reconstruction radon transform and inverse radon transform.

### 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.

### **Analog electronics**

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

### **Digital Circuits:**

Number systems; Combinatorial circuits; Boolean algebra, minimization of functions using Boolean identities and Karnaughmap, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexes, decoders, encoders, PALs and PLAs; Sequential circuits; latches and flip-flops, counters, shift-registers and finite state machines; Data converters; sample and hold circuits, ADCs and DACs; Semiconductor memories; ROM, SRAM, DRAM; 8-bit microprocessor (8085); architecture, programming, memory and I/O interfacing.

### **Control Systems**

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

### **Communications**

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

### **Electromagnetics:**

**Electromagnetics; Maxwell's equations:** differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and

properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers, Modal Analysis of a step index fiber, Attenuation and dispersion in optical fibers, Optical sources and detectors, Optical Amplifiers, Optical link design.

### 3. Department of Mechanical Engineering

#### Section 1: Applied Mechanics and Design

**Engineering Mechanics:** Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

**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; concept of shear centre; 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.

**Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the SN 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.

#### Section 2: Fluid Mechanics and Thermal Science

**Fluid Mechanics:** Fluid properties; fluid statics, 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, bends and fittings; basics of compressible fluid flow.

**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.

### **Section 3: Materials and Manufacturing**

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

**Casting, Forming and Joining Processes:** Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. 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; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

**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.

### **Section 4: Industrial Engineering**

**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; additive manufacturing. Robotics and Mechatronics.

**Production Planning and Control:** Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

**Inventory Control:** Deterministic models; safety stock inventory control systems.

**Operations Research:** Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.





## ANNEXURE-1

### **AUTHORITIES WHO CAN ISSUE CASTE/TRIBE CERTIFICATE**

**Scheduled Caste (SC)/Scheduled Tribe (ST) /Other Backward Class (OBC-NCL):** For admission to a seat reserved for Scheduled Caste/Scheduled Tribe/Other Backward Class (NCL), candidate must produce a certificate, in original, issued from an approved district authority stating the Scheduled Caste/ Scheduled Tribe/ Other Backward Class (NCL), to which the candidate belongs. A list of approved authorities is given below:

- a. District Magistrate / Additional Magistrate / Deputy Commissioner / Collector / Additional Deputy Commissioner / Deputy Collector / 1st Class Stipendiary Magistrate / City Magistrate (not below the rank of 1st Class Stipendiary Magistrate), Sub-Divisional Magistrate / Taluka Magistrate / Executive Magistrate / Extra Assistant Commissioner.
- b. Revenue Officer not below the rank of Tehsildar.
- c. Sub-Divisional Officer of the area where the candidates and/or his/her family normally resides
- d. Administrator/Secretary to Administration/Development Officer (Laccadive & Minicoy Islands).

**(Certificate issued by any other authority will not be accepted.)**

#### **Prescribed Format for OBC Certificate**

##### FORM OF CERTIFICATE TO BE PRODUCED BY OTHER BACKWARD CLASSES

This is to certify that Shri / Smt. / Km. \_\_\_\_\_ Son  
/Daughter of Shri / Smt. \_\_\_\_\_ of  
Village/Town \_\_\_\_\_ District/Division \_\_\_\_\_ in  
the State belongs to the \_\_\_\_\_ Community which is  
recognized as a backward class under:

(i)Resolution No. 12011/68/93-BCC(C) dated 10/09/93 published in the Gazette of India Extraordinary Part I Section I No. 186 dated 13/09/93.

(ii)Resolution No. 12011/9/94-BCC dated 19/10/94 published in the Gazette of India Extraordinary Part I Section I No. 163 dated 20/10/94.

(iii)Resolution No. 12011/7/95-BCC dated 24/05/95 published in the Gazette of India Extraordinary Part I Section I No. 88 dated 25/05/95.

(iv)Resolution No. 12011/96/94-BCC dated 9/03/96. (v)Resolution No. 12011/44/96-BCC dated 6/12/96 published in the Gazette of India Extraordinary Part I Section I No. 210 dated 11/12/96.

(v)Resolution No. 12011/13/97-BCC dated 03/12/97.

(vi)Resolution No. 12011/99/94-BCC dated 11/12/97.

(vii)Resolution No. 12011/68/98-BCC dated 27/10/99.

(viii)Resolution No. 12011/88/98-BCC dated 6/12/99 published in the Gazette of India Extraordinary Part I Section I No. 270 dated 06/12/99.

(ix)Resolution No. 12011/36/99-BCC dated 04/04/2000 published in the Gazette of India Extraordinary Part I Section I No. 71 dated 04/04/2000.

(x)Resolution No. 12011/44/99-BCC dated 21/09/2000 published in the Gazette of India Extraordinary Part I Section I No. 210 dated 21/09/2000.

(xi)Resolution No. 12015/9/2000-BCC dated 06/09/2001.

(xii)Resolution No. 12011/1/2001-BCC dated 19/06/2003.

(xiii)Resolution No. 12011/4/2002-BCC dated 13/01/2004.

(xiv)Resolution No. 12011/9/2004-BCC dated 16/01/2006 published in the Gazette of India Extraordinary Part I Section I No. 210 dated 16/01/2006.

Shri / Smt. / Kum. \_\_\_\_\_ and / or his family ordinarily reside(s) in the \_\_\_\_\_ District / Division of \_\_\_\_\_ State. This is also to certify that he/she does not belong to the persons/sections (Creamy Layer) mentioned in Column 3 of the Schedule to the Government of India, Department of Personnel & Training O.M. No. 36012/22/93-Estt. (SCT) dated 08/09/93 which is modified vide OM No. 36033/3/2004 Estt. (Res.) dated 09/03/2004.

Dated: \_\_\_\_\_

District Magistrate / Deputy Commissioner /  
Competent Authority

Seal

NOTE:

(a) The term 'Ordinarily' used here will have the same meaning as in Section 20 of the Representation of the People Act, 1950.

(b) The authorities competent to issue Caste Certificates are indicated below:

(i) District Magistrate / Additional Magistrate / Collector / Deputy Commissioner / Additional Deputy Commissioner / Deputy Collector / Ist Class Stipendiary Magistrate / Sub-Divisional magistrate / Taluka Magistrate / Executive Magistrate / Extra Assistant Commissioner (not below the rank of Ist Class Stipendiary Magistrate).

(ii) Chief Presidency Magistrate / Additional Chief Presidency Magistrate / Presidency Magistrate.

(iii) Revenue Officer not below the rank of Tehsildar and

(iv) Sub-Divisional Officer of the area where the candidate and / or his family resides.



**Declaration/undertaking - for OBC Candidates only**

I, \_\_\_\_\_ son/daughter of Shri \_\_\_\_\_  
resident of village/town/city \_\_\_\_\_ district  
\_\_\_\_\_ State \_\_\_\_\_ hereby declare that I belong to the  
\_\_\_\_\_ community which is recognized as a backward class by the Government of India  
for the purpose of reservation in services as per orders contained in Department of Personnel and  
Training Office Memorandum No.36012/22/93- Estt. (SCT), dated 8/9/1993. It is also declared that I do  
not belong to persons/sections (Creamy Layer) mentioned in Column 3 of the Schedule to the above  
referred Office Memorandum, dated 8/9/1993, which is modified vide Department of Personnel and  
Training Office Memorandum No.36033/3/2004 Estt. (Res.) dated 9/3/2004.

Signature of the Candidate

Place: \_\_\_\_\_

Date: \_\_\_\_\_

