



श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान

तिरुवनन्तपुरम, केरल - 695 011

SREE CHITRA TIRUNAL INSTITUTE FOR
MEDICAL SCIENCES AND TECHNOLOGY, TRIVANDRUM

Thiruvananthapuram - 695011, Kerala, India

(एक राष्ट्रीय महत्व का संस्थान, विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार)

(An Institution of National Importance, Dept. of Science & Technology, Govt. of India)

शैक्षणिक कार्यक्रम

ACADEMIC PROGRAM

एम एस बायोमेडिकल साइंसेज एंड इंजीनियरिंग

MS Biomedical Sciences and Engineering

सूचीपत्र

PROSPECTUS

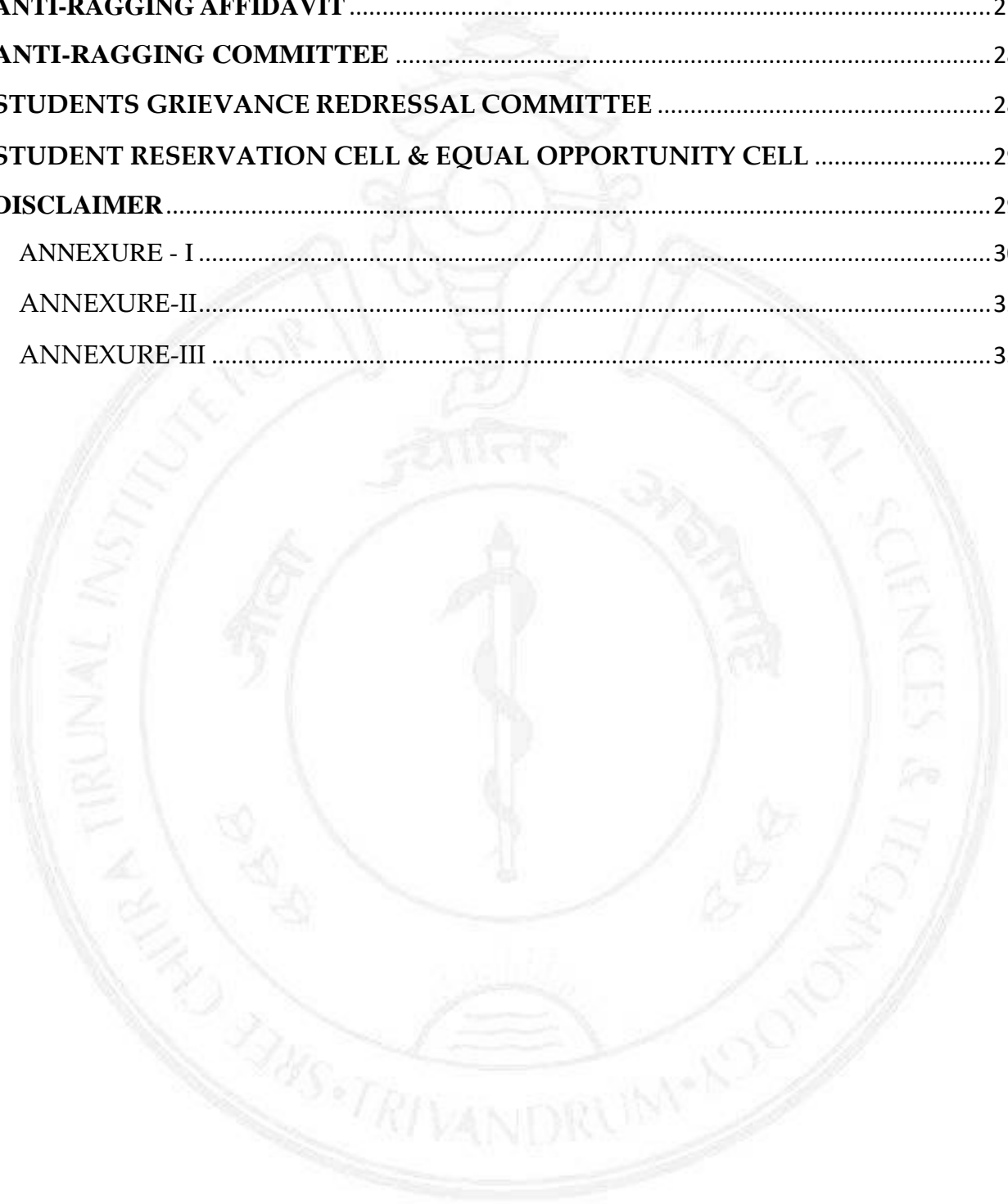
जुलाई सत्र-2023

JULY SESSION – 2023

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Introduction

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) is an Institution of National Importance with the status of a University under the Department of Science and Technology, Government of India, by an Act of Parliament (Act 52 of 1980). The joint culture of medicine and technology that the Institute pioneered more than four decades ago has come of age and has gained unprecedented acceptance in India. The Institute focuses on advanced super-specialty postgraduate training programs in medical specialties and health research of social relevance, and the development of high-quality medical devices and technology of industrial significance. The emphasis is on the development of activities less readily available in the country, such as interventional radiology, interventional stroke care, cardiac electrophysiology, advanced cardiothoracic and vascular surgery, management of epilepsy and movement disorders, micro-, spinal and endoscopic neurosurgery, development of new biomedical devices and products, evaluation of medical devices to global specifications, novel academic programs, and health science research and training.

The Institute has three wings – the Hospital Wing, the Biomedical Technology Wing, and the Achutha Menon Centre for Health Science Studies Wing. Excellent research and learning opportunities are available at these wings. The Institute has a dedicated team of clinicians, scientists and engineers devoted to high-quality medical research, biomedical research, technological development and public health research.

The Institute's objectives are to:

- Promote biomedical engineering and technology.
- Provide and demonstrate high standards of patient care in advanced medical specialties.
- Develop innovative postgraduate training programs of the highest quality in advanced medical specialties, as well as in biomedical engineering and technology.
- Participate in public health reforms through research, training, and interventions.

The Sree Chitra Tirunal Institute for Medical Sciences & Technology Act, 1980, empowers the Institute to offer post-graduate programs in medical sciences, public health and biomedical engineering. To promote the above-specified objectives, the institute now offers post-graduate teaching and training in biomedical sciences and technology through an MS program.

About the MS Program

Biomedical Sciences and Engineering play an important role in the modern healthcare. There is a huge and growing demand in India as well as across the globe for medical devices. India, being one of the major users of medical devices and implants, depends on imports for over 80% of its needs. The nation is striving to expand its capabilities and human resources in medical devices and implants and to become self-sufficient in these areas.

The Government of India has introduced a 'Production Linked Incentive' scheme in medical device manufacturing to encourage domestic manufacturing, attract significant investments, reduce reliance on imports, and attain self-sufficiency (*Atmanirbhar Bharat*) in this industry segment. To achieve this goal, manpower is required to be trained in the specialty areas, such as biomedical science and technology, medical device development, testing and validation of biomaterials, translational research, pre-clinical and clinical evaluation, laboratory animal sciences, and regulatory requirements. To meet this imminent demand, focused courses and training in the above areas of biomedical sciences and engineering are to be implemented. The Master of Science program in 'Biomedical Sciences and Engineering' (MS BMSE) was conceived to address the above need.

Course Structure

- The MS Biomedical Sciences and Engineering curriculum is of a 4-semester duration.
- Each academic year has 2 semesters of roughly 18-week duration for **each**, respectively (based on the working weeks of the institute, omitting the days of evaluation/exams)
 - Semester I / III: July - December
 - Semester II / IV: January - June
- The first semester will consist of Core Module Courses, common to all MS specializations.
- The second semester will have Elective Courses based on the selected specialization and project. The three specializations offered are: i) Applied Biosciences, ii) Biomaterials, and iii) Medical Devices.
- The third and fourth semesters are meant for mentored thesis research. The research initiation and progress will be supervised by an Advisory Committee. Scholars are expected to carry out their research activity on campus in SCTIMST. Research work off-campus will be permitted to sponsored candidates in case an MoU exists that directly facilitates academic activities between the respective institutions.

- The medium of instruction, examination, and project report for all courses is English. The syllabi and curricula of the program are subject to revision from time-to-time.

Scope

This course is structured to impart knowledge and training on developing medical devices that meet performance, safety, and regulatory criteria. Students will be encouraged to bring innovative solutions to various unmet clinical needs. Training in the three specializations, namely, Applied Biosciences, Biomaterials, and Medical Devices will be provided by the faculty experts of the corresponding Departments of the Biomedical Technology Wing, SCTIMST. The specialized science and engineering skills required will be imparted through short-term course projects, wherein the students will be trained to use scientific and technical knowledge and state-of-the-art tools. The whole gamut of medical device development, from identifying user needs, choices of design and materials, modeling and simulation, testing and validation, *in vivo* models, to clinical trials will be covered during the course. The importance of innovation and intellectual property will also be introduced to the students. On successful completion of the program, the student will be well-poised to take up appropriate roles in the industry, research arenas, and in academia.

Program Description

An appropriate foundation in engineering principles, science, technology, and its practice in the biomedical area will be provided through this program. The emphasis will be to provide a comprehensive understanding of the medical device development life-cycle to the students. This includes identifying user needs from the perspective of clinicians, users and patients, the conceptualization of the devices, their design and development, validation, regulatory requirements, translation, and manufacturing. The program will also address the choice and selection of biomaterials for various applications. Biomedical signal and image analysis will also be covered and will equip the student with modern data-driven systems for diagnosis and treatment. The course aims to equip students to conduct systematic research in Biomedical Science, innovate and develop medical devices using a need-based approach, manage device-related risks, ensure performance as well as safety, teach device prototyping and testing under a quality management framework, generate intellectual property and give directions to help the candidates communicate their work effectively in front of the international community.

Mode of Selection

The selection will be based on the entrance exam conducted by Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum. The entrance examination will be conducted in three streams, namely, Biological Sciences, Materials Sciences and Engineering, covering the fundamental aspects. The selection will be based on the following:

- (i) Statement of purpose submitted by the prospective students.
- (ii) Performance of the candidate in the entrance examination.
- (iii) Academic and/or industrial proficiency.
- (iv) Performance in the interview by the short-listed candidates.

Eligibility Requirements

Candidates having the following qualifications are eligible to apply:

- M.Sc. in any discipline of science, OR
- Bachelor's degree in Engineering, Technology, or equivalent in the disciplines of:
 - (i) Biomedical Engineering,
 - (ii) Electronics / Electronics & Communication / Instrumentation / Applied Electronics
 - (iii) Electrical / Electrical & Electronics
 - (iv) Mechanical / Production
 - (v) Computer Science
 - (vi) Chemical Engineering
 - (vii) Polymer / Rubber technology
 - (viii) Materials / Metallurgical Engineering
 - (ix) OR Equivalent disciplines
- The candidate should have attained a CGPA ≥ 6.5 or equivalent marks.

Sponsored candidates from the industry/academia

Sponsored candidates, satisfying the above criteria, will have to apply through the proper channel and submit a 'No Objection Certificate' from their employer along with their application forms. The decision of the Institute regarding the eligibility of sponsorship shall be final.

Eligible sponsored candidates seeking admission will have to appear for the interview. They need not write the entrance examination. No other type of preference will be given to sponsored candidates.

All sponsored applicants are also required to submit two confidential reference letters while submitting the application form. Also, the candidates must provide certification of proficiency in English. They will be mandatorily required to submit a certification from their sponsor stating that the financial cost of the entire duration of the course will be borne by the sponsoring organization/institution.

Overseas students

Selection will be based on educational qualifications, professional experience, the sponsoring organizations' assessments, and an online interview.

Fee Structure

Admission Fee (₹)	
Application fee	*1,500
Admission fee	1,000
Caution deposit	10,000
Library	1,000
Student welfare fund	1,000
Miscellaneous fee (Identity card, etc.)	500
Total (A)	15,000

Tuition Fee (₹) (To be paid semester-wise)	
Semester 1	25,000
Semester 2	25,000
Semester 3	25,000
Semester 4	25,000
Total (B)	1,00,000

Exam Fee (₹)	
Semester 1	1,000
Semester 2	1,000
Thesis evaluation	5,000
Total (C)	7,000

* The application fee for candidates belonging to SC/ST category is Rs. 1200/-.

Total fee for the MS BMSE program (A+B+C) = ₹ 1,22,000 (INR One lakh twenty-two thousand only).

The fee may be revised by the Institute periodically. Eligible candidates can apply for the e-Grantz scheme of the Government of Kerala for fee support/scholarships.

Note: For any additional certificates from the Division of Academic Affairs (DAA), a 'Certificate fee' of Rs. 1000/- per certificate will be paid to DAA. 'Re-exam fee' of Rs. 1000/- may be applicable on a case-to-case basis if additional/separate examination is required to be conducted for the candidate. Hostel fees and mess fees are not included in the above fee structure. Fees once paid will not be refunded.

Accommodation

Hostel facilities on a shared basis are available for students on a payment basis.

Important Dates

Admission notification	15th March 2023
Availability of online application	15.03.2023 to 14.04.2023 (up to 5.00 pm)
Hall ticket download	Ten days prior to the entrance examination
Date of entrance examination	20th May 2023
Date of interview	09th June 2023
Commencement of the program	1st July 2023

Entrance Examination and Interview

SCHEDULE OF ENTRANCE EXAMINATIONS AND FINAL INTERVIEW	
Entrance Examination	The written examination will be conducted on 20 th May 2023. All applicants are requested to visit the online application portal as well as the Institute website (www.sctimst.ac.in) for updates. Intimation regarding the Hall Ticket will be sent to the applicant's registered email ID only.
Centers for the entrance examination	The entrance examination will be conducted in the following cities - Chennai, Mumbai, New Delhi, Kolkata and Thiruvananthapuram. A candidate needs to indicate the order of their preference for all examination centers. If a center gets cancelled, the candidates will be reassigned to the center of their next choice. A center may be merged with another, if there are less than ten

	candidates registered for that center, or in case of any other eventualities.
Type of questions and marking scheme	The entrance test will consist of Objective type Multiple Choice Questions (MCQs). One mark will be given for the correct answer. There will not be any negative marking.
Interview	The interview of the qualified candidates will be held on 9 th June 2023, at SCTIMST, Thiruvananthapuram.
<p>Examination rules:</p> <ol style="list-style-type: none"> 1. Entry to the entrance examination hall will be allowed only upon the production of the Hall Ticket. (In case the applicant did not receive the Hall Ticket 8 days prior to the date of examination, they will need to contact the academic office). 2. No candidate will be allowed to enter the examination hall 15 minutes after the commencement of the examination. 3. No request for postponement of the entrance examination/change of examination center will be entertained under any circumstances. 4. No electronic gadgets including cell phones/watches, etc. will be allowed in the examination hall. 5. The results of the entrance examination will be published on the institute's website/notice board. <p>Interview: The date and time of the interview will be published on the SCTIMST website (www.sctimst.ac.in). No separate intimation will be sent to the short-listed candidates. The institute WILL NOT bear the expenses of the candidates for appearing for the interview.</p> <p>The final selection list will be published on the SCTIMST website and notice board.</p>	

Course Curriculum

- MS Biomedical Sciences and Engineering curriculum will be interdisciplinary and will be of a 4-semester duration.

- Each academic year will have 2 semesters of roughly an 18-week duration for each semester, respectively (based on the institute working weeks, omitting the days of evaluation/exams).
 - Semester I / III: July - December
 - Semester II / IV: January - June
- The courses will consist of CORE courses in Biomedical Sciences and Engineering and will be common to all students. The ELECTIVES would be chosen based on the student's research interests and the advice of the research mentor. The curriculum will cover specific subjects along with courses that enrich innovation, management and scientific communication skills. Typically, per week, the courses will consist of 15 hours of lectures and 15 hours of laboratory work/assignments.
- In the first year, the students will get practical exposure to Biomedical Sciences and Engineering (through the Laboratory Modules), and will have to participate in laboratory internships in any of the laboratories in the concerned departments.
- The last two semesters of the MS program are for mentored research that will culminate in a thesis. Students will start working on a research area in the third semester of study under the supervision of a mentor. The research will be supervised by a Research Advisory Committee (RAC), composed of a Research Advisor (or Mentor), Co-Advisor, and a Nominee of the Head of the Department. RAC will be formed based on the recommendation of the Mentor, subject to recommendation by the Head of the Department and approval from the Dean, Academic affairs. Scholars are expected to carry out their research activities on campus. Off-campus research work will be permitted for sponsored candidates in case an MoU exists between SCTIMST and the sponsoring organization/institution that directly facilitates academic activities.
- The research area will preferably be identified as an unmet clinical need by a Clinical Faculty of SCTIMST. This unmet need must be researched in depth to arrive at a solution. The Co-Advisor could be a Clinical Faculty along with a Clinical Resident, who is also working simultaneously on the clinical aspects in the same area.
- The medium of instruction, examination and project report for all courses will be English. The syllabi and curricula of the program may be revised from time-to-time. On course commissioning, a Syllabus Revision Committee (SRC) will be formed that includes the Faculty guiding the student, under the Head of the Department. SRC will meet once a year and recommend changes in the syllabus and course systems for the incoming admissions, as deemed necessary. Recommendations from SRC on the course conducted in the department will be

passed on to the Division of Academic Affairs for approval, through the proper channel, for implementation.

- The maximum number of students admitted per batch will be 10 (out of this 4 will be in the sponsored quota). The reservation norms of Government of India will be followed for admission. Out of the four sponsored seats, two seats can be reserved for candidates currently in service. For sponsored candidates, a 'No Objection Certificate' from their employers granting the candidate permission to undertake the program and a commitment by them to meet the candidate's expenses, will be required (see Annexure III for the format).

Requirements for the Award of MS Degree

MS Biomedical Sciences and Engineering program will follow a credit-based system for the successful completion of the degree. Each course will have assigned credits, and continuous assessment will be used to assign a letter grade to a student enrolled in that course, based on a relative grading scheme. A cumulative grade point average (CGPA) will be calculated using the student's letter grades. The following are the minimum requirements for the award of the MS degree:

- Each student will be expected to acquire a minimum of 66 credits with a CGPA of 5.0 or greater to become eligible for the MS degree.
- If the student completes the courses but receives less than 30 credits and leaves, he/she will be given an Academic Transcript attesting the credits obtained and the attendance.
- Successful completion of the research thesis is mandatory for the award of the MS degree.
- Scholars will be encouraged to attend conferences/seminars related to their area of work by the Mentor.
- The student will be encouraged to prepare manuscripts for publication and/or to file patent applications related to their areas of work prior to the submission of the thesis.

Coursework and Assessment

The progress of the students will be assessed using: (i) Written reports, (ii) Oral presentations, (iii) Laboratory reports, (iv) Examinations, and (v) Thesis.

Guidelines for Assessment

1. **Marks for courses:** Marks will be awarded on the basis of written examinations and internal assessments. This can be utilized to assess the student's performance and provide training in reporting and presentation skills. The written assessment will be for 60% to 80% of the total marks allotted for the course.
2. **Written assessment (or written examination):** This will be held after the completion of the required class-hours. A written assessment (or written examination) will be held for a course that carries a credit value of 2 or above. The courses with credits less than 1 may be clubbed together for a single written assessment. Laboratory modules and laboratory internships will be assessed based on the reports submitted by the students.
3. **Minimum attendance required for the written examination:** Admission for the written assessment (or written examination) will be restricted to students who have secured a minimum of 80% attendance. Lack of attendance on medical grounds will be permitted on the production of a medical certificate from a licensed medical practitioner (for a maximum time period of three months).
4. **Examination/assessment format:** To ensure uniformity and quality of the content, written examinations will be carried out based on the following guidelines: (i) Multiple choice question format will not be followed; (ii) The examination shall consist of 4 to 5 essays for 10 marks each, 5 to 8 detailed questions for 5 marks each, and can also include 5 to 10 brief essay questions of 2 to 3 marks each; (iii) Choice may be provided in the question paper by the faculty based on the type of course being attended.
5. **Internal assessment/assignments:** At least one oral presentation will be assigned based on the subject area and one assignment will be required in the written/typed form. 20-40 marks per module will be assigned to this activity. 10-15 marks will be assigned for oral presentations/seminars and 10-25 marks for project work. Marks can be allotted based on presentations and assignments by the faculty. For example, if 100 marks are the total marks available for assessment to obtain 3 credits for a particular course, 60 - 80 marks will be allotted to the written exam and 20 - 40 marks will be allotted to the internal assessment.
6. **Academic review:** Scholars should be made aware that academic activity will be reviewed thoroughly, and plagiarism or unethical practices in any form will not be tolerated. In case any unethical activity, and/or plagiarism is detected, the mentor of the student, the RAC and the Head of the Department will be notified. Further action, as mandated, will be recommended by the RAC.

7. **Thesis:** This shall be a comprehensive document covering all gamuts of the research work from its inception, literature review, to reporting of results. The format of MS thesis and guidelines, as published with updates from time-to-time on the SCTIMST website, should be followed.
8. **Thesis evaluation:** The thesis will be evaluated by two external examiners nominated by the HOD as well as the research mentor.
9. **Date of submission of thesis:** The due date for the submission of the thesis will be on the last working day of the penultimate month of the 4th semester. This will provide a three-week window for the division of academic affairs to review and gather comments from the two external examiners before the *viva voce examination* is scheduled.

Assessment Criteria

Marks for subjects (10 courses + 2 internships) 10 exams of 100 marks each as per the schedule	1200
Total marks for research work (800 for the lab work and 400 for the thesis)	1200
Maximum marks	2400
Credits	
Total credits for semesters I & II (1 st year)	36
Minimum credits required for passing the first year	30
Total credits for the research work (hours spent in the laboratory)	36
Minimum credits required for qualifying for the MS program	66

Grade	Performance	Cumulative Grade Point Average (CGPA/5)	% Equivalent
A plus	Excellent	5.0	≥ 95
A	Very Good	4.5	90 - 94.9
A minus	Good	4.0	80 - 89.9
B plus	Fair	3.5	70 - 79.9
B	Satisfactory	3.0	60 - 69.9
B minus	Minimum pass	2.5	50 - 59.9
F	Fail	0	< 50
I	Incomplete		
W	Withdrawal		

Grading Method

The scoring system used for evaluating the academic performance of the students will be the Grade Point Average (GPA) [Semester Grade Point Average (SGPA), and Cumulative Grade Point Average (CGPA)]. The equations used for determining these scores are:

$$GPA = \frac{\sum_i (C_i \cdot GP)}{\sum_i C_i}$$

Where C_i is the credit of the course; GP is the grade point of that course, and \sum_i is the sum of the credits of all registered courses successfully cleared during that semester/ program.

For converting GPA into marks (%), the following formula will be used: Marks (%) = $(GPA \cdot 100/5)$.

For assessing the attendance of the candidate, the following codes will be used:

Attendance Codes		
Attendance rounded to	Remarks	Code
$\geq 95\%$	Very good	VG
80 - 94%	Good	G
$< 80\%$	Poor	P

Evaluation During the Course

Course & Marks: 100 Marks for each course

- Written Exam: 60 - 80 Marks (*for each course exam*)
- Seminars/Assignment: 10 - 20 Marks (*for each course*)
- Course Project / Practical: 10 - 30 Marks (*for each course*)

Laboratory Internship Marks: 100 marks (*for the report and presentation*)

Marks for Research Project: 800 (*assessed by the Monitoring Committee, including the mentor*)

Marks for Research Thesis: 400 (*based on the defense of the thesis*)

Course Conduct and Monitoring

- (i) The Course Conduct Committee (CCC) shall be responsible for the day-to-day activities related to the course administration and problem resolution, and shall be the point of coordination between the Department and the Division of Academic Affairs (DAA).

- (ii) Course Conduct Committee will be formed of faculty members actively participating in the courses from the host department. The Head of the Department will be the ex-officio Chairman of the committee. The committee will appoint a Course Coordinator and Assistant Coordinator(s), as required to facilitate the smooth conduct of the program.
- (iii) On the completion of admission procedures, the Course Conduct Committee will inform the faculty members and provide them with the list of students admitted to the program. The committee will invite abstracts of the project proposals from faculty for project assignments and organize student-faculty interactive sessions in order to build rapport and help the students address any concerns.

Course Coordinator

The Course Coordinator will be responsible for managing the delivery of the program to students. They shall ensure the maintenance of quality of the academic programs and assist the students in understanding various aspects of the course.

Research Advisory Committee

The constitution of the Research Advisory Committee (RAC) will be as follows:

- (i) RAC will be formed towards the end of the second semester.
- (ii) The RAC will consist of: (i) a dedicated faculty member who will serve as the mentor to the student for his research thesis; (ii) a faculty member nominated by the Head of the Department where the specialized curriculum (second semester) is being conducted; and, (iii) a co-mentor (a faculty from SCTIMST).
- (iii) The nominee of the Head of the Department (where the specialized curriculum is being conducted) will serve as the Chairman of the RAC.

Responsibilities of the Research Advisory Committee

- (i) RAC will provide a holistic guidance to the scholar during his entire course period at SCTIMST.
- (ii) RAC will organize research seminars, and recommend learning resources and external training that will help scholars under its tutelage.
- (iii) RAC shall hold its first meeting as soon as students are assigned to their mentors.
- (iv) RAC shall facilitate the familiarization of the students with their research work and also ensure the conduction of harmonious and high-quality research work.
- (v) RAC shall meet to assess the work plan and the initial literature review in the last month of the second semester.

- (vi) RAC shall meet in the last month of the third semester to assess the work progress and the quality of data collection. RAC will provide directions to ensure the completion of the thesis in a time-bound manner.
- (vii) RAC shall meet on demand by the students to address any specific issues.
- (viii) Mentor can initiate the RAC meetings to apprise the RAC of any issues of concern at any time.
- (ix) RAC meetings shall be held in person or via the online mode. Minutes of the meeting will be filed with the CCC for maintenance of record.

Course Feedback

Online course feedback will be collected from every student for each course credited by him/her.

Essential Criteria for Completing Courses

- (i) Students are expected to attend all classes and the attendance will be recorded in every class. Students with an overall attendance of 80% or above only will be permitted to write the end-semester examination.
- (ii) To attend the semester that follows, the students should have completed ALL prerequisite courses (if any) with at least a 'B minus' grade.
- (iii) Those students who score a 'F' grade in a course will be given an opportunity to repeat the final examination. During the re-examination, obtaining at least a 'B minus' grade will be the mandatory passing criterion. Underperforming students may be given remedial classes before repeating the final examination.
- (iv) Repeating a course will not be permitted if the student has obtained a 'B minus' grade or above in the same course.
- (v) The incomplete grade 'I' is a transitional grade that will be given to the students who miss the end-semester examinations under unexpected circumstances (e.g., serious medical reasons) as determined by the MS Course Coordinator, in consultation with the concerned Head of Department (related to the specialization) and should be approved by the Dean, Academic Affairs. In these extenuating circumstances, the students will be permitted to appear in the next scheduled final examination, provided they have an 80% attendance and fulfill other academic requirements, as per the rules and regulations of the Institute. The actual grade obtained after this examination will be considered and will replace the 'I' grade previous given to the candidate. In case a student obtains an 'F' grade in this final examination, he/she will be eligible to write the repeat final examination. If the absence of a student in an examination is not approved by the Dean (Academic Affairs) [e.g., if there is a

deliberate attempt to skip the examination], he/she will be awarded zero marks in that particular course examination. The final grade in that course will be determined based on the other examinations of that course taken by the student.

- (vi) Withdrawal from a course registered for, by the student in a semester will usually be permitted under very special cases, e.g., due to prolonged illness. The grade 'W' will be given in these circumstances and the student will be asked to repeat the concerned course with the same course number. He will be allowed to undertake all the necessary examinations along with the next batch. The new grade obtained by the student will be taken into consideration and placed in the transcript of the result. However, the previous grade 'W' will also appear in the transcript of the result.
- (vii) The 'W' grade will not have any effect on the calculation of CGPA. If a student has a 'W' grade in a registered course in a particular semester, CGPA will be calculated based on the grades obtained in other courses of that semester.
- (viii) If a student does not clear a CORE course even after completing the repeat final examination, he/she will be required to repeat the course with the same course number prior to the conduct of the next final examination. Until the course is repeated and passed by the student, it will be treated as a backlog in the student's records. Both the grades, the new grade, and the previous 'F' grade, will appear in the grade transcripts.
- (ix) An 'F' grade obtained in a course will contribute to the CGPA until:
 - a. The course with the same course number is completed with a 'B minus' grade or better (applicable for core courses) or
 - b. The course is substituted with an alternative course of the respective Department and is completed with a minimum of 'B minus' grade (applicable only for elective courses).
- (x) A maximum of one backlog course from the first year may be allowed, at the discretion of the Dean (Academic Affairs) and the Director, before a student can choose a research area and proceed to the second year's courses.
- (xi) A student who has more than two 'F' and/or 'W' grades in a particular semester of the first year will have to repeat all the courses of that semester. Only the new grades obtained in all the courses will be taken into consideration and the previous grades will be converted to 'W' grades.
- (xii) The student will get to the next semester(s) by completing all the courses of the previous semester by registering and completing the end-semester examination as per rule, and after meeting other academic requirements, based on the Course Diary.

Course Scheduling

The course layout is made considering 200 days of working per year.

First year: 36 credits – Courses (30 credits) + Laboratory Internship (6 credits);

- Days for coursework per semester: 90 days (omitting examination days)
 - Daily sessions: 3 hrs teaching + 3 hrs practical
 - Teaching: 270 hrs + Practical: 270 hrs (available per semester)
 - Teaching hours per credit: 15.
- Courses per semester: 4; Laboratory Internship per semester -1
 - Teaching / Seminar / Assignments: ~54 hrs per 3 credit course.
 - Practical hours: ~36 hrs per 3-credit course
 - Lab internship hours: ~90 hrs lab work per semester.

Second year: 36 credits – Research Project / Thesis

Research work for 200 working days: 36 credits

Temporal Layout of the Course

MS BIOMEDICAL SCIENCES AND ENGINEERING PROGRAM			
Course Layout	Module Layout	Credits	Evaluation
SEMESTER 1			
Course 1 - Introduction to Applied Biosciences (Total 45 hours)	<i>Module 1:</i> Introductory Biology – Cell structure and functions, genes, and chromosomes.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Basics of Anatomy and Physiology.		
	<i>Module 3:</i> Basics of Biochemistry and Molecular Genetics		
Course 2 - Introduction to Biomaterials (Total 45 hours)	<i>Module 1:</i> Essentials of Materials for Biomedical Applications	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Classification and Properties of Biomaterials		
	<i>Module 3:</i> Characterization of Biomaterials		
Course 3 –	<i>Module 1:</i> Classification, Design & Reliability.	3 credits	Written Exam -

Introduction to Medical Device Technology (Total 45 hours)	<i>Module 2:</i> In vitro evaluation, in vivo evaluation, cleaning, packaging and sterilization.		100 marks
	<i>Module 3:</i> Manufacturing, Quality Systems, Clinical Evaluation & Regulation.		
Course 4 – Orientation to Research (Total 45 hours)	<i>Module 1:</i> Research Methodology, Experimental design.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Tools and Techniques of Research; Biostatistics.		
	<i>Module 3:</i> Scientific Conduct and Ethics, Intellectual Property Rights		
Laboratory Module	Materials and Devices Assignment - 1	1 credit	100 marks
	Materials and Devices Assignment - 2	1 credit	
	Materials and Devices Assignment - 3	1 credit	
Internship 1	Device Development and Evaluation Study	3 credits	100 marks
SEMESTER 2: SPECIALIZATION – APPLIED BIOSCIENCES			
Course 5A - Biological & Safety Evaluation (Total 45 hours)	<i>Module 1:</i> Cytotoxicity and Cytocompatibility Evaluation	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Toxicological Evaluation		
	<i>Module 3:</i> Microbiological Evaluation		
Course 6A - In-vivo & Pre-clinical Evaluation (Total 45 hours)	<i>Module 1:</i> Laboratory Animal Science, Ethics and Welfare, Regulatory Aspects.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> In Vivo Functional Safety Evaluation, Experimental Design, Small and Large Animal Models.		
	<i>Module 3:</i> Experimental Pathology, Preclinical Testing for Safety and Efficacy of Medical Devices		
Course 7A - Immunology (Total 45 hours)	<i>Module 1:</i> Innate and Acquired Immune Response, Hypersensitivity	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Immune Response to Implants		
	<i>Module 3:</i> Immuno-Compatibility and Immune Toxicity Assessment		

Course 8A - Tissue Engineering & Regenerative Medicine (Total 45 hours)	<i>Module 1:</i> Introduction to Tissue Engineering and Regenerative Medicine.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Scaffolds – Cell-Matrix Interaction, Biodegradable Polymer Scaffold.		
	<i>Module 3:</i> Biofabrication – Bioassembly, 3D Cell Culture and Bioinks, Bioreactors.		
Laboratory module	Laboratory Techniques in Applied Biosciences – Part I	1 credit	100 marks
	Laboratory Techniques in Applied Biosciences – Part II	1 credit	
	Laboratory Techniques in Applied Biosciences – Part III	1 credit	
Internship 2A	Industry/Device Evaluation	3 credits	100 marks
SEMESTER 2: SPECIALIZATION – BIOMATERIALS			
Course 5B - Drug Delivery & Wound Healing (Total 45 hours)	<i>Module 1:</i> Introduction Drug Delivery Systems and Materials; Polymers for Delivery Systems; Methods of Preparing Polymeric Nano and Micro-Particles.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Fundamentals of Controlled Drug Delivery, Smart and Stimuli-Sensitive Systems, Release Mechanism and Kinetics, Peptide and Gene Delivery.		
	<i>Module 3:</i> Wound Healing Principles, Wound Care Devices and Materials.		
Course 6B - Polymeric Biomaterials (Total 45 hours)	<i>Module 1:</i> Basics of Polymers, Types of Polymers, Polymers in Medicine	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Different Types of Polymerization, Important Techniques of Polymerization.		
	<i>Module 3:</i> Polymer Properties and Characterization.		
Course 7B - Biomaterials Processing Techniques	<i>Module 1:</i> Processing of Plastics, Metals and Ceramics.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Surface Processing and Bulk Processing		

(Total 45 hours)	Module 3: Additive Manufacturing Techniques, 3D Printing, Electro-Spinning		
Course 8B - Nano Biomaterials (Total 45 hours)	Module 1: Basics and Advances in Nano-Bio Materials, Synthesis and Properties.	3 credits	Written Exam - 100 marks
	Module 2: Polymeric Nanoparticles. Metallic Nanomaterials. Nanostructured Materials.		
	Module 3: Applications of Nanomaterials in Drug Delivery and Diagnostics.		
Laboratory module	Laboratory Techniques in Biomaterials – Part I	1 credit	100 marks
	Laboratory Techniques in Biomaterials – Part II	1 credit	
	Laboratory Techniques in Biomaterials – Part III	1 credit	
Internship 2B	Industry/Device Evaluation	3 credits	100 marks
SEMESTER 2: SPECIALIZATION – MEDICAL DEVICES			
Course 5C – Biomechanics (Total 45 hours)	Module 1: Introduction to Biomechanics, Viscoelasticity of Soft Tissues.	3 credits	Written Exam - 100 marks
	Module 2: Properties of Tendons And Passive Muscles, Muscle Mechanics.		
	Module 3: Transformation Matrices, Dynamic Measurement Methods, Introduction to Human Walking, Design of Assistive Devices.		
Course 6C – Computational Modelling in Biomedical Engineering (Total 45 hours)	Module 1: Numerical Solutions to Differential Equations, Finite Element Method, Fluid Dynamics, Fluid Structure Interactions	3 credits	Written Exam - 100 marks
	Module 2: Tissue Models, Medical Device Modeling.		
	Module 3: Performance Optimization, Quality of Results, Mesh Quality, Mesh Convergence.		
	Module 1: Various Device Segments	3 credits	

Course 7C – Medical Device Segments (Total 45 hours)	<i>Module 2:</i> Electromechanical Devices.		Written Exam - 100 marks
	<i>Module 3:</i> Medical Instrumentation.		
Course 8C – Biomedical Signal and Image Processing (Total 45 hours)	<i>Module 1:</i> Overview of Signals and Images.	3 credits	Written Exam - 100 marks
	<i>Module 2:</i> Imaging Modalities and Processing.		
	<i>Module 3:</i> Artificial Intelligence and Machine Learning, Their Application in Biomedical Signals and Images.		
Laboratory module	Laboratory Techniques in Medical Devices – Part I	1 credit	100 marks
	Laboratory Techniques in Medical Devices – Part II	1 credit	
	Laboratory Techniques in Medical Devices – Part III	1 credit	
Internship 2C	Industry/Device Evaluation	3 credits	100 marks

Total marks for written examinations and lab modules (1st and 2nd semester)	1000
Total marks for internships (1st and 2nd semester)	200
Total marks for research progress evaluation (end of 3rd semester)	400
Total marks for thesis evaluation (end of 4th semester)	400
Total marks for thesis defense (end of the program)	400
Total marks for the MS program	2400

Credits Requirements	
Total credits for Semesters I & II (1 st year)	36
Minimum credits required for passing the first year	30
Total credits for the Research Work (hours spent in the laboratory)	36
Minimum credits required for qualifying the MS program	66

General Information

Duration: The four-semester program commences on 1st July 2023.

Reservation: As per the Government of India norms.

- **Number of seats:** 10 (ten), (out of ten, four seats are reserved for sponsored candidates, and out of these four, two seats will be reserved for candidates currently in service. A 'No Objection Certificate' from their employers indicating permission to undertake the program and commitment to meet expenses will be required).
- The 6 seats as per the roster will be distributed as follows for admission to the July 2023 session:

UR	OBC	SC	ST	EWS	PWD
4	1	1	0	0	0

Application Procedure

Application form and application fee are to be submitted through the ONLINE MODE ONLY through our website: www.sctimst.ac.in.

All bank charges are to be borne by the applicant.

Application fee (in Rupees): Rs. 1500 (Rs. 1200 for SC/ST candidates)

It is mandatory to bring printouts of the filled application form, duly signed original certificates to prove age, qualification, and experience at the time of admission along with self-attested copies of the following documents:

- a. Online payment receipt of application fee.
- b. A valid Caste certificate for SC/ST/OBC (non-creamy layer) candidates (issued by revenue authorities, not below the rank of Tahsildar).
- c. Eligible candidates applying under the EWS category are required to produce an EWS certificate issued by a competent authority in the prescribed format given in the annexures.
- d. 'No Objection Certificate' in the case of employed/sponsored applicants in the prescribed format given in the annexures will be required.

General Instructions

1. The online application can be filled out from: **17.03.2023 to 16.04.2023**

2. For online application submission, please visit <https://www.sctimst.ac.in/Academic%20and%20Research/Academic/Admissions/> (www.sctimst.ac.in home page → Academic → Admissions → Register/Login to Fill up & Submit Application).
3. Avoid submitting multiple applications; duplicate applications from an applicant will result in the cancellation of all such applications. The candidate should fill in the online application with utmost care and follow the instructions.
4. It will be the candidate's responsibility to ensure that the correct details are filled in the online application form. SCTIMST will not be responsible for any incorrect information/cancellation of candidature/loss or lack of communication, etc., due to an incorrectly filled online application form.
5. The candidate must ensure that no column is left blank. The candidate must complete the filling of the application form in one go.
6. Candidates will also be provided with a 'Login' facility after successful registration of their application. Candidates can take the print-out of the application form from the dashboard of the Online Application Portal by entering the application number, email identity, and date of birth provided at the time of submission of the application.
7. If the applicant is an employee of a State or Central Government or Public Sector Undertaking, a 'No Objection Certificate' should be obtained from the employer prior to the submission of the online application. This certificate should be produced at the time of entrance examination/clinical, practical and viva-voce/interview.
8. The rules are subject to change in accordance with decisions of the Institute taken from time to time.
9. All correspondence will be through the registered email/mobile number.
10. The screening committee appointed by the Institute reserves the right to accept/reject an application.

List of documents to be uploaded

The list of documents to be uploaded at the time of online application are listed below:
The photograph should be in jpeg format and all other documents shall be in pdf format.

1. A passport-size photograph (with white background).
2. An authentic document to prove the age.

3. Caste certificate for SC/ST/OBC (Non-creamy layer) issued by revenue authorities, not below the rank of Tahsildar (valid as per Government of India norms).
4. Documents to prove the EWS category, if applicable.
5. Documents to prove the PwD category, if applicable.
6. 'No Objection Certificate' in case the candidate is employed.
7. Certificates to prove academic qualifications and achievements.

Hall Ticket/Call Letter

Eligible candidates for the entrance examination can download the hall ticket/ call letter ten days before the scheduled date for the entrance examination from the portal of our website www.sctimst.ac.in. Please bring this card with you for entering the examination hall.

Address for Contact

For more information, please contact:

The Deputy Registrar,
Division of Academic Affairs,
Sree Chitra Tirunal Institute for Medical Sciences and Technology,
Thiruvananthapuram - 695011, Kerala, India.
Contact telephone Nos.: (0471) 2524269, 2524289, and 2524649.
Email: regoffice@sctimst.ac.in

ANTI-RAGGING AFFIDAVIT

Ragging in all its forms is prohibited in the Institute

All candidates, at the time of admission to the Institute, will be required to furnish an undertaking in the form of an affidavit that the candidate will not indulge in any form of ragging. If the selected candidate is found to be ragging another student, the Institute may take appropriate action against him/her.

The directive of the Hon'ble Supreme Court regarding ragging will be followed strictly. As per the direction of the Hon'ble Supreme Court of India, "the Government has banned ragging completely in any form inside and outside of the campus and the Institute authorities are determined not to allow any form of the ragging. Whoever directly or indirectly commits, participates in, abets or instigates ragging within or outside any educational Institution, shall be suspended, expelled or rusticated from the Institution and shall also be liable to a fine which may extend to Rs.10,000/-. The punishment may also include cancellation of admission, suspension from attending the classes, withholding/withdrawing fellowship/scholarship and other financial benefits, or withholding or cancelling the result. The decision shall be taken by the Head of the Institution."

Prohibition of and Punishment for Ragging:

1. Ragging in any form is strictly prohibited, within the premises of the Institution and any part of SCTIMST and also outside SCTIMST.
2. Ragging for the purpose of these rules, ordinarily means any act, conduct or practice by an individual or any collective act by which dominant power or status of senior students/residents is brought to bear on students/residents freshly enrolled or students/residents who are, in any way, considered junior or inferior by other students/residents which:
 - i) Involve physical assault or threat or use of physical force.
 - ii) Violate the status, dignity and honor of women students.
 - iii) Violate the status, dignity and honor of physically disabled/transgender students.
 - iv) Violate the status, dignity and honor of students/residents belonging to the Scheduled Castes, Scheduled Tribes and other Backward Castes.
 - v) Exposes students/residents to ridicule and contempt and affects their self-esteem.
 - vi) Entail verbal abuse and aggression, indecent gesture and obscene behavior.
- 3) The Dean, Associate Dean, Registrar, Hostel Warden and HoDs of SCTIMST may conduct a suo-moto enquiry into any ragging incident and report to the Director the identity of those who have engaged in ragging and the nature of the incident. The Director of SCTIMST shall take necessary action based on the report.

Any person aggrieved in this matter may fearlessly approach the Student Grievance and Redressal Committee/Anti-Ragging Committee/Associate Dean (Faculty and Student Affairs)/ Division of Academic Affairs of SCTIMST for a fair and concerned hearing and redressal.

ANTI-RAGGING COMMITTEE

1	Director	Chairman
2	Head, BMT Wing	Member
3	HoD, Cardiology	Member
4	HoD, CVTS	Member
5	HoD, Neurology	Member
6	HoD, Neurosurgery	Member
7	HoD, Anaesthesiology	Member
8	HoD, IS&IR	Member
9	HOD, AMCHSS	Member
10	Lecturer in Nursing	Member
11	One Parent Representative	Member
12	One Junior student representative	Member
13	One Senior student representative	Member
14	Mrs. Priya P., Administrative Officer	Member
15	AAO (Academic)	Convener

STUDENTS GRIEVANCE REDRESSAL COMMITTEE

1.	Dr. Rakhal Gaitonde, Professor, AMCHSS.	Chairman
2.	Dr. Sanjay G., Professor, Cardiology	Member
3.	Dr. Ajai Prasad Hrishi P., Additional Professor, Anaesthesiology	Member
4.	Dr. Ramesh P., Scientist G, Division of Polymeric Medical Devices	Member
5.	Dr. Anugya Bhatt, Scientist G, Division of Thrombosis Research	Member
6.	Dr. Jissa V.T., Scientist C, AMCHSS	Member
7.	Ms. Suja Raj L., Lecturer in Nursing	Member
8.	Mr. Tijo George, PhD student	Member
9.	Ms. Divya M.R.	SC/ST representative
10.	A student representing the Wing where the grievance has occurred to be nominated by the Dean / Director	Special invitee

STUDENT RESERVATION CELL & EQUAL OPPORTUNITY CELL

Associate Dean (Faculty & Student Affairs)	Liaison Officer (Ex-officio)
Nodal officer for scholarships to students in the Institute	Member (Ex-Officio)
Dr. Roy Joseph	Member
Dr. Biju Soman	Member
Dr. Unnikrishnan K.P.	Member
Er. Ranjith G.	Member
Mr. A Imthiaz Ahmed	Parent Representative
Registrar	Member
Mr. Sunil L.	PwD Member
Ms. Deepthy Chandran A.	Student Member
Deputy Registrar	Convener

DISCLAIMER

While every effort has been made to ensure the accuracy of this information at the time of publication, addition, updates, alterations, and changes in circumstances may occur between the time of publication and the time the user views the information. The Institute advises users to verify the accuracy and completeness of the information with the Academic Division in case of any doubt (0471-2524269).

DIRECTOR

FORM OF CERTIFICATE TO BE PRODUCED BY OTHER BACKWARD CLASSES APPLYING
FOR ADMISSION TO CENTRAL EDUCATIONAL INSTITUTIONS (CEIs), UNDER THE
GOVERNMENT OF INDIA

This is to certify that Shri/Smt./Kum. 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.
- vi. Resolution No. 12011/13/97-BCC dated 03/12/97. vii. Resolution No. 12011/99/94-BCC dated 11/12/97. viii. Resolution No. 12011/68/98-BCC dated 27/10/99.
- ix. 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.
- x. 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.
- xi. 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.
- xii. Resolution No. 12015/9/2000-BCC dated 06/09/2001. xiii. Resolution No. 12011/1/2001-BCC dated 19/06/2003. xiv. Resolution No. 12011/4/2002-BCC dated 13/01/2004.
- xv. 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.
- xvi. Resolution No. 12011/14/2004-BCC dated 12/03/2007 published in the Gazette of India Extraordinary Part I Section I No. 67 dated 12/03/2007.
- xvii. Resolution No. 12015/2/2007-BCC dated 18/08/2010.
- xviii. Resolution No. 12015/13/2010-BCC dated 08/12/2011.

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 and further modified vide OM No. 36033/3/2004-Estt. (Res.) dated 14/10/2008 and further modified vide OM No. 36033/1/2013-Estt (Res.) dated 27/05/2013 or the latest notification of the Government of India.

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 / Taluk 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.

The date of issue of OBC (NCL) certificate should be within one year from the last date of application.

Government of

(Name & Address of the authority issuing the certificate)

INCOME & ASSET CERTIFICATE TO BE PRODUCED BY ECONOMICALLY WEAKER SECTIONS.

Certificate No _____ Date: _____

VALID FOR THE YEAR _____

This is to certify that Shri/Smt./Kumari _____
 son/daughter/wife of _____ permanent resident of
 _____, Village/Street _____ Post Office
 _____ District _____ in the State/ Union Territory
 _____ Pin Code _____ whose photograph is attested below
 belongs to the Economically Weaker Section, since the gross annual income* of his/her
 "family"** is below Rs.8 lakhs (Rupees Eight Lakhs only) for the financial year _____ .
 His/her family does not own or possess any of the following assets***

- I. 5 acres of agricultural land and above;
- II. Residential flat of 1000 sq. ft. and above;
- III. Residential plot of 100 sq. yards and above in notified municipalities;
- IV. Residential plot of 200 sq. yards and above in areas other than the notified municipalities.

2. Shri/Smt./Kumari _____ belongs to
 the _____ caste which is not recognized as a Scheduled Caste, Scheduled
 Tribe and Other Backward Classes (Central List)

Signature with seal of Office _____

Name _____

Designation _____

Recent passport size
 attested photograph of
 the applicant

***Note 1:** Income covered from all sources, i.e., salary, agriculture, business, profession, etc.

****Note 2:** The term "Family" for this purpose includes the person, who seeks benefit of reservation, his/her parents and siblings below the age of 18 years as also his/her spouse and children below the age of 18 years

*****Note 3:** The property held by a "Family" in different locations or different places/cities have been clubbed, while applying the land or property holding test to determine the EWS status.

(To be provided on the letterhead of the institution)

No...., Date.....

No Objection Certificate

Mr./Ms. is an employee in the Department of atHe/She wishes to apply for theprogram of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum. The has no objection related to his/her undergoing the said program at..... during the period from ...to The will sponsor him on this program.

With best regards,

(Signature of the sponsoring authority)