राष्ट्रीय प्रौद्योगिकी संस्थान वारांगल

National Institute of Technology Warangal

Hanamkonda, Warangal-506004, Telangana

Senate Minutes

Meeting No.:	137
Date:	11th September 2024
Time	16.00 hours
Venue:	Senate Hall, NIT Warangal

Minutes of 137th Meeting of the Senate held on 11th September 2024

Prof. Bidyadhar Subudhi, Chairman
Director, NIT Warangal

Prof. N.V. Umamahesh
Registrar (I/c), NIT Warangal

Members Present:

1. Prof. A. Sarath Babu (CH)
2 Prof. A. Venu Gopal (ME)
3 Prof. A. Venu Vinod (CH)
4 Prof. Adepu Kumar (ME)
5 Prof. Amit Prashant, IIT GN
6 Prof. Asit Kumar Khanra (MM)
7 Prof. B. Lakshmi (EC)
8 Prof. B. Sathish Ben (ME)
9 Prof. B.L. Narasimha Raju (EE)
10 Prof. C. Vanitha (MM)
11 Prof. C.S.R.K. Prasad (CE)
12 Prof. Ch. Sudhakar (CS)
13 Prof. Ch. Venkaiah (EE)
14 Prof. D. Kasinath (CY)
15 Prof. D. Srinivasa Charya (MA)
16 Prof. D. Vakula (EC)
17 Prof. D.V.S.S. Siva Sarma (EE)
18 Prof. Debashis Dutta (MA)
19 Prof. Divi Haranath (PH)
20 Prof. G. Amba Prasad Rao (ME)
21 Prof. G. Nagasrinivasulu (ME)
22 Prof. G. Rajesh Kumar (CE)
23 Prof. G.V.S. Nageswara Rao (MM)
24 Prof. Hari Ponnamma Rani (MA)
25 Prof. J.V. Ramana Murthy (MA)
26 Prof. K. Anand Kishore (CH)
27 Prof. K. Kiran Kumar (ME)
28 Prof. K. Madhavi (HS)
29 Prof. K. Narasimhulu (BT)
30 Prof. K. Thangaraju (PH)
31 Prof. K. Venkata Reddy (CE)
32 Prof. K.V. Gobi (CY)
33 Prof. K.V. Sai Srinadh (ME)
34 Prof. KNS Kasiviswanadham (MA)
35 Prof. L. Anjaneyulu (EC)
36 Prof. L. Krishnanand (ME)
37 Prof. M. Heera Lal (CE)
38 Prof. M. Sailaja Kumari (EE)
39 Prof. Mahesh Kumar Talari (MM)
40 Prof. N. Bheema Rao (EC)
41 Prof. N. Kishore Babu (MM)
42 Prof. N. Narasaiah (MM)
43 Prof. N. Selvaraj (ME)
44 Prof. N.V. Umamahesh (CE)
45 Prof. P. Abdul Azeem (PH)
46 Prof. P. Bangaru Babu (ME)
47 Prof. P. Hari Krishna (CE)
48 Prof. P. Ratish Kumar (CE)
49 Prof. P. Sreehari Rao (EC)
50 Prof. P. Sreenivasa Rao (BT)
51 Prof. P. Subhash Chandra Bose (ME)
52 Prof. P. Venkata Sri Laxmi (CY)
53 Prof. P. Venkata Suresh (CH)
54 Prof. Pisipati Radha Krishna (CS)
55 Prof. R. Narasimha Rao (ME)
56 Prof. R. Satish Babu (BT)
57 Prof. Rashmi Ranjan Rout (CS)
58 Prof. Ravi Kumar Jatoth (EC)
59 Prof. S. Anuradha (EC)
60 Prof. S. Srinivasa Rao (EE)
61 Prof. S. Srinivasa Rao (ME)
62 Prof. S. Venkateswara Rao (CE)
63 Prof. Sonawane Shirish Hari (CH)
64 Prof. Sourabh Roy (PH)

65 Prof. Srikanth Korla (ME)
66 Prof. T. Kishore Kumar (EC)
67 Prof. T. Venkatappa Rao (PH)
68 Prof. T.D. Gunneswara Rao (CE)
69 Prof. V. Hari Kumar (ME)
70 Prof. V. Venkata Mani (EC)
71 Prof. Vangapandu Rama Devi (MS)
72 Prof. Velagapudi Vasu (ME)
73 Prof. Venkaiah Chowdary (CE)
74 Prof. Vishnu Shanker (CY)
75 Prof. Y. Ravi Kumar (ME)

Special Invitees:

1 Prof. A. Benerji Babu (Head, MA)
2 Prof. B. Rama Raju (Head, BT)
3 Prof. M. R Viswanadhan (Head, HS)
4 Prof. S. Vidyasagar, (Head, CH)
5 Prof. Santhosh P. (Head, CY)
6 Prof. Sunitha G (Head, MS)
7 Prof. D. Bhargavi (AD-PG)
8 Prof. KVR Ravi Shankar (AD-PhD)
9 Prof. Syed Ismail (AD-UG)
10 Sri. V. Upendar (AR, Aca)

Student Representative:

1. Mr M Navaneeth, 21PHRER02

The following members could not attend the meeting:

1 Prof. A. Veeresh Babu (ME)
2 Prof. Arif Ali Baig Moghal (CE)
3 Prof. Ashok K. Pradhan, IIT KGP
4 Prof. B. Lakshmi (EC)
5 Prof. B. Sri Padmavati, UOH
6 Prof. Bhagwan K. Murthy (EE)
7 Prof. C.S.P. Rao (ME)
8 Prof. D. Jayakrishna (ME)
9 Prof. D. Ramaseshu (CE)
10 Prof. K. Madhu Murthy (ME)
11 Prof. K. Ramesh (CS)
12 Prof. M. Joseph Davidson (ME)
13 Prof. N. Viswanathan (EE)
14 Prof. N.V. Srikanth (EE)
15 Prof. P. Ramlal (MS)
16 Prof. P. Ravi Kumar (PE)
17 Prof. P. Syam Prasad (PH)
18 Prof. P. Vamsi Krishna (ME)
19 Prof. P. Venkateswara Rao (CE)
20 Prof. Puli Ravi Kumar (ME)
21 Prof. R. Padmavathy (CS)
22 Prof. R.B.V. Subrahmanyam (CS)
23 Prof. S. Srinath (CH)
24 Prof. V. Rajesh Khana Raju (ME)
25 Prof. V. Ramana Murthy (CE)
26 Prof. V. Suresh Babu (ME)
27 Prof. V.P. Chandra Mohan (ME)
28 Prof. V.T. Somasekhar (EE)
29 Prof. Venkatathri Narayanan (CY)

Leave of absence was approved for all the members who could not attend.

The Chairman, Senate welcomed all the Senators. All the Senators have taken the **Swachhata pledge** under the guidance of the Chairman, Senate.

Part-A [In the presence of Student Representatives]

2024-137-Senate-01	Item Related to Student Activities

None.

PART-B [Without the presence of the Student Representatives]

2024-137-Senate-02	Action Taken report on the decisions taken in 135th and 136th Senate meetings

135th Senate meeting

2024-135-Senate	Nomination of Student Representatives to the Senate	The student representatives have been invited to 137th Senate
2024-135-Senate-01	Student Representations	Ms. Sri Vidhya Komarina (Roll No. 21ECSJ093) has been sanctioned with another semester break.
2024-135-Senate-03	Confirmation of the minutes of 134th Senate meeting	The minutes of 134th Senate meeting approved by the Senate has been uploaded on the Institute website.
2024-135-Senate-04	Change of Supervisor/inclusion of Co-supervisor	The DSCs for the Scholars have been revised accordingly.
2024-135-Senate-05	Conversion from Project Fellow to Institute Fellow	JRFs having served for two years under Project have been converted into Institute Fellow w.e.f. the date of closure of the project. The Scholar having served for one year in the Project has been advised to apply for PhD admission in the December 2024 session
2024-135-Senate-06	Results of Ph.D. Viva Voce Examination	Senate Noted
2024-135-Senate-07	Academic Calendar for the Autumn Semester for students admitted in July 24 Session	The Academic Calendar approved by the Senate is implemented.
2024-135-Senate-08	Guidelines for offering a common course by different teachers	The item is placed before the 137th Senate as it was deferred in 135th Senate.
2024-135-Senate-09	Mechanism to facilitate Slow Learners.	The suggestions/guidelines from the Committee appointed for this purpose is awaited.
2024-135-Senate-10	Opening of New Academic Departments	The proposal from the Departments is awaited.
2024-135-Senate-11	M.Tech Thesis Evaluation Scheme	The approved guidelines have been updated in the Regulations for implementation from this semester.
2024-135-Senate-12	Any other item with the permission of the Chair	The decision of the Senate, that a student found/indulged in

		malpractices in any examination, then he/she shall be marked with F grade in all the courses of that semester will be implemented from the current semester.

136th Senate meeting

2024-136-Senate-01	Proposal to address the Issue of Slow Learners	The decisions of the Senate applicable to the students admitted in 2024-25 have been updated in the Academic regulations. Transitory Guidelines for existing students have been implemented and the students have completed the registrations.
2024-135-Senate-02	Any other item (a) Special Makeup Examinations (b) Internship in Industry/Research Lab for M.Tech students	The Special makeup exam for Final year students having one backlog will be conducted in December, 2024. Noted.

The Senate noted the action taken reports.

2024-137-Senate-03	**Confirmation of the minutes of 135th and 136th Senate meetings**

The minutes of the 135th and 136th meetings of the Senate were circulated to all the senators. Based on the comments received from the Senators, the following modifications have been incorporated in the minutes of the 136th Senate meeting. The evaluation criterion is as follows:

Attendance	10
Teacher Assessment (Assignment, Project, Seminar, Quiz test etc. or any assessment method at the discretion of the teacher.)	20
Minor Examination -1	15
Minor Examination-2	15
Major Examination	40

The Senate confirmed the minutes of the 135th and 136th Senate Meetings with above modifications.

2024-137-Senate-04	Items for Ratification

(a) Change of Supervisor/inclusion of Co-Supervisor

Sl. No.	Roll No.	Name of the Scholar	Name of the Department	Existing Co-Supervisor	Proposed New Supervisor & Co-Supervisor	Remarks
1	23ECR2P05	Ms. Hemalatha N	EC	Prof. A. Prakasa Rao Dr. M. Sree Ramana Sc-F, RCI	Dr. D. R. Jahagirdar Sc-H, RCI	Request by the Student

The Senate approved the change of Co-Supervisor.

(b) Request of Sri Teshome G. Salemu for Comprehensive Viva Voce Examination in 4th Semester

The request of Sri Teshome G. Salemu(CE), a full time Research Scholar for permitting him to appear for the comprehensive viva exam in the 4th semester, recommended by the DSC has been approved by Chairman, Senate.

The Senate ratified the decision of the Chairman, Senate.

(C) Extension in PhD Programme to Mr. P. Chandra Sekhar

Sri Chandrasekhar (Roll No. 716169), Part-time PhD Scholar in the Department of Chemical Engineering has been granted an extension of 6 months by the Chairman, Senate. Further extension will be decided based on the progress of the Scholar in this semester.

The Senate ratified the decision of the Chairman, Senate.

2024-137-Senate-05	Results of Ph.D. Viva Voce Examination

The results of the following Ph.D. students who have been provisionally awarded degrees after 135th Senate meeting 02-08-2024 on approval of the Chairman, Senate is placed before the Senate for information.

PhD Results		
	Mr. Harminder Singh Johar	
	Department	EE
	Roll No.	701611
	Date of Viva-voce Examination	14.08.2024

1	Foreign Examiner	Prof. Faz Rahman, University of New South Wales, Australia
	Indian Examiner	Dr. Ranjan Kumar Behera, IIT-Patna
	Supervisor(s)	Prof. S. Srinivasa Rao and Dr. Abhijit Bhattacharyya-DRDO
	Thesis Title	Fault-Tolerant Electrical Systems for Aerospace Applications
2	**Ms. Lalitha Devi B**	
	Department	H&SS
	Roll No.	701975
	Date of Viva-voce Examination	14.08.2024
	Foreign Examiner	Dr. Margaret Sutherland Senior Lecturer, University of Glasgow, UK
	Indian Examiner	Prof. S.P. Dhanawal, IIT, Madras
	Supervisor(s)	Prof. Madhavi K and Prof. Madhumathi P - RGNIYD
	Thesis Title	Improving L2 Proficiency, Classroom English, and Awareness levels (L2 Self-Efficacy, Teaching Efficacy, Learning Strategies) of First-Year Pre-Service Teachers under Kakatiya University using TBLT
3	**Ms. Aarti Gautam**	
	Department	CY
	Roll No.	719116
	Date of Viva-voce Examination	20.08.2024
	Foreign Examiner	Prof. Dilip. K. Sarkar, Université du Québec à Chicoutim Saguenay
	Indian Examiner	Prof. C. Retna Raj, IIT, Kharagpur
	Supervisor(s)	Prof. K. V. Gobi and Dr. R. Subasri, ARCI, Hyderabad
	Thesis Title	Self-healing corrosion protection coatings based on corrosion inhibitor encapsulated nano-containers for mild steel
4	**Mr. Nagireddy Nageswara Reddy**	
	Department	CE
	Roll No.	718006
	Date of Viva-voce Examination	20.08.2024
	Foreign Examiner	Dr. John S. Schwartz, University of Tennessee, USA
	Indian Examiner	Prof. Ashish Pandey, IIT, Roorkee
	Supervisor(s)	Prof. Venkata Reddy Keesara
	Thesis Title	Streamflow and Sediment Yield Analysis for Evaluating Best Management Practices under Changing Climate
5	**Mr. A. Bhanuchandar**	
	Department	EE
	Roll No.	718123
	Date of Viva-voce Examination	22.08.2024
	Foreign Examiner	Prof. Akshay Kumar Rathore, Singapore Institute of Technology, Singapore
	Indian Examiner	Prof. Siva Kumar K, IIT, Hyderabad
	Supervisor(s)	Prof. Bhagwan K Murthy
	Thesis Title	Implementation and Analysis of Generalized Floor Function Based Modulated Model Predictive Current Control Technique For Single Phase Self-Balanced Type Multilevel Inverter Topologies
6	**Mr. Ramesh Babu Pallapati**	
	Department	EE
	Roll No.	718125
	Date of Viva-voce Examination	23.08.2024
	Foreign Examiner	Prof. Sheldon Williamson, Ontario Tech University, Canada
	Indian Examiner	Dr Rupesh Wandhare, IIT Hyderabad
	Supervisor(s)	Prof. Ramulu Chinthamalla

	Thesis Title	Design and Implementation of Electrolytic Capacitor-less Reduced Power Processing Single-Phase LED Drivers
7	**Mr. Vutla Vijay**	
	Department	EE
	Roll No.	718016
	Date of Viva-voce Examination	27.08.2024
	Foreign Examiner	Prof. Ramakrishna Gokaraju, University of Sanskatchewan, Canada
	Indian Examiner	Prof. Suresh Chandra Srivastava, Retd. Professor, IIT Kanpur
	Supervisor(s)	Prof. Ch. Venkaiah
	Thesis Title	Investigations on the Optimal Planning of Electric Vehicle Charging Stations in coupled network using Meta Heuristic Techniques
8	**Mr. Praveen Kumar Mudidhe**	
	Department	EC
	Roll No.	720054
	Date of Viva-voce Examination	27.08.2024
	Foreign Examiner	Dr. S. Vollebregt, Delft University of Technology, The Netherlands
	Indian Examiner	Prof. Roy P. Paily, IIT Guwahati
	Supervisor(s)	Prof. N Bheema Rao
	Thesis Title	Modeling and Simulation of Gate and Channel Engineered Cylindrical FET
9	**Mr. Ramakanth Angatha**	
	Department	CE
	Roll No.	716107
	Date of Viva-voce Examination	29.08.2024
	Foreign Examiner	Prof. Shuaian Wang, The Hong Kong Polytechnic University, Hong Kong
	Indian Examiner	Prof. Praveen Kumar, CED, IIT, Roorkee
	Supervisor(s)	Prof. Arpan Meher
	Thesis Title	Effect of Traffic Volume on Ambient AIR Quality on Multilane Divided Urban Roads and Signalized Intersections
10	**Mr. Koppala Sreelatha**	
	Department	CE
	Roll No.	716002
	Date of Viva-voce Examination	29.08.2024
	Foreign Examiner	Prof. Sangam Shrestha, Asian Institute of Technology Thailand
	Indian Examiner	Prof. Eldho T.I., IIT Bombay, Mumbai
	Supervisor(s)	Prof. P. Anand Raj
	Thesis Title	A Study on Regional Drought Analysis using Teleconnections and Suitable Global Climate Models for Telangana State
11	**Mr. J. Lakshmi Prasanna**	
	Department	EC
	Roll No.	720062
	Date of Viva-voce Examination	29.08.2024
	Foreign Examiner	Prof. Deepak Dubal, Brisbane, Australia
	Indian Examiner	Prof. Ambesh Dixit, IIT- Jodhpur
	Supervisor(s)	Prof. Ekta Goel
	Thesis Title	Novel Structural Engineering Techniques to Enhance the Efficiency of Perovskite Solar Cells
12	**Mr. U. Shivani Sri Varshini**	
	Department	CS
	Roll No.	719087
	Date of Viva-voce Examination	02.09.2024
	Foreign Examiner	Prof. Dr Sunil Vadera, University of Salford, UK

	Indian Examiner	Dr. M. Narasimha Murty, Honorary Professor, IISc., Bangalore
	Supervisor(s)	Prof. RBV Subramanyam
	Thesis Title	Some Studies on Data Driven Models for Detection of Fake News in Social Media Content
13	**Mr. Slokashree Padhi**	
	Department	CS
	Roll No.	21CSRES01
	Date of Viva-voce Examination	03.09.2024
	Foreign Examiner	Prof. Vincenzo PIURI, University of Milan, Italy
	Indian Examiner	Prof. Subhash Chander Sharma, IIT, Roorkee
	Supervisor(s)	Prof. RBV Subramanyam
	Thesis Title	Some Studies on Renewable Energy-Based Scheduling Algorithms for Geo-Distributed Data centres
14	**Ms. JYOTSNA PRIYAM**	
	Department	BT
	Roll No.	718157
	Date of Viva-voce Examination	06.09.2024
	Foreign Examiner	Dr. Gautam Sethi, National University of Singapore
	Indian Examiner	Prof. Mirza S Baig, IIT - Indore
	Supervisor(s)	Prof. Urmila Saxena
	Thesis Title	Comprehensive Genomic and Epigenomic Data Analysis to Investigate the Role of Myc in Renal Cancer
15	**Ms. Saritha Gorantala**	
	Department	MA
	Roll No.	720104
	Date of Viva-voce Examination	06.09.2024
	Foreign Examiner	Prof. Rama Subba Reddy Gorla, Air Force Institute of Technology, Ohio, USA
	Indian Examiner	Prof. Natesan Srinivasan, IIT, Guwahati
	Supervisor(s)	Prof. D. Srinivasacharya
	Thesis Title	Boundary Layer Flow of A Casson Fluid Past A Thin Needle

The Senate noted the results of the Ph.D. students.

2024-137-Senate-06	**Items for information**

(a) **Filling of the Vacant M.Tech seats through Self-Finance Mode**

A proposal to fill up the vacant seats in the M.Tech programmes in the institute after completing all the CCMT rounds through self-finance mode was placed in the 66th meeting of the BoG on 12th August 2024. The BoG approved the same. The vacant seats will be filled up by conducting an Institute level Spot round following the due procedure to ensure merit.

(b) **Engagement as Adjunct Professors**

The following have been appointed as Adjunct Professors for a period of one year.

S. No.	Department	Adjunct Professor	Remarks
1	ME	Dr. A. Venugopal Rao, Retired. Outstanding Scientist, Associate Director, DMRL Hyderabad	One-year from the date of the first visit.
2	PH	Dr. Jane Alam Retired. Outstanding Scientist Variable Energy Cyclotran Centre, Kolkata and Senior Professor (HAG), HBNI, Mumbai	One-year from the date of the first visit.
3	MM	Dr. G. Madhusudhan Reddy, Retired. Outstanding Scientist, DMRL Hyderabad	Upto 3rd Sept. 2025

(c) **Conversion of JRF to Institute Fellow**

For conversion of JRF in to Institute Fellow, the JRF shall have to work for a minimum of two years under Project. If the JRF experience in the Project is for a period less than 2 years, the JRF needs to apply for admission into regular PhD program before the closure of the Project. The allotment of the Supervisor and the course work already completed by the JRF will be considered.

The Senate noted the information.

2024-137-Senate-07	**Guidelines for conferment the Honorary Doctorates and DSc in the Convocation**

A committee was constituted by the Chairman, Senate to submit guidelines for conferment of Honorary Doctorates and DSc in the Convocations. The committee submitted the guidelines as which was placed in Annexure-I for consideration and approval of the Senate.

The Senate considered the guidelines drafted by the Committee and approved the same with following modifications.

- ***Honorary Fellowships may be Omitted***
- ***Biology and Medicine may be dropped while Humanities and Management be added.***
- ***The number of Honorary Doctorates need not be limited to ONE.***
- ***The Search and Selection Process will be entrusted to a Committee nominated by the Chairman, Senate.***

2024-137-Senate-8	Guidelines for preparation of Synopsis and Thesis

A committee was constituted by the Chairman, Senate to submit guidelines for preparing the Synopsis and Thesis along with templates both in MS WORD and LaTex. The committee has submitted the report. The report is given in Annexure-II.

The Senate expressed satisfaction on the proposed guidelines and approved the same. The Senate also suggested the said committee to submit template for Synopsis.

2024-137-Senate-9	Guidelines for offering e-Masters, Certificate and Executive Programs

The committee constituted by the Chairman, Senate for the purpose of submitting guidelines for offering e-Masters, Certificate and Executive programs has submitted the report, which is placed in Annexure-III for consideration of its approval.

The Senate suggested that the committee s appointed for this purpose may come out with unified guidelines for discussion in the next Senate.

2024-137-Senate-10	Guidelines for offering a common course by different teachers

It is observed that when a common course is offered by more than one faculty members, the students express their concern on the question papers, coverage of syllabus and evaluation of answer sheets. In view addressing the said issue, the following guidelines are proposed.

There will be coordinator amongst the faculty members handling the common course across several sections. For the uniformity, based on the coverage of the syllabus, a common question may be prepared for the mid semester and end-semester examinations. It is also suggested to formulate a uniform evaluation scheme. However, the evaluation may be performed by individual faculty member.

The Senate accepted this proposal with a suggestion to implement from the End semester examinations of the current semester.

2024-137-Senate-11	Admission of students into various programs for the AY 2024-25

(a) **Admission of students into various programs for the Academic Year 2024-25**

B.Tech/Int. MSc. Admissions

Branch	JoSAA Intake	JoSAA admitted	ICCR Intake	ICCR admitted	SII Intake	SII admitted	DASA GENERAL Intake	DASA GENERAL admitted	DASA (CIWG) Intake	DASA (CIWG) admitted	COMPEX (NEPAL) Intake	COMPEX (NEPAL) admitted	TOTAL INTAKE	TOTAL ADMITTED
CE	110	113	4	0	10	0	6	1	2	2	2	0	134	116
EE	130	128	5	1	10	0	10	7	4	3	2	0	161	139
ME	130	129	5	0	10	0	7	5	3	3	2	0	157	137
EC	100	99	5	1	14	4	20	20	10	10	2	0	151	134
EC(VLSI)	40	40	2	0	10	2	7	6	4	4	0	0	63	52
MM	72	69	1	0	5	0	3	0	2	1	2	0	85	70
CH	110	108	4	1	10	0	7	1	3	3	2	0	136	113
CS	135	134	5	0	16	6	21	20	10	10	2	0	189	170
AI&DS	60	60	2	0	10	4	8	6	4	4	2	0	86	74
BT	72	70	1	0	5		3	2	2	1	2	0	85	73
M & C	30	30	2	0	10	4	8	8	3	3		0	53	45
MA	20	20	1	0	2	0	1	0	1	0	0	0	25	20
PH	20	18	1	0	2	0	1	0	1	0	0	0	25	18
CY	20	17	1	0	2	0	1	0	1	0	0	0	25	17
ITEP*	50	0	0	0	2	0	0	0	0	0	0	0	52	0
TOTAL	1099	1035	39	3	118	20	103	76	50	44	18	0	1427	1178

*The admissions into ITEP (BSc. BEd.) are in progress.

M.Tech Admissions

Dept.	Existing Specialization	Sanctioned Strength	Seats Filled	No. of Vacancies	Self-Finance	Seats Filled	No. of Vacancies	% Seats Filled CCMT + SF
CE	Engg. Structures	35	35	NIL	5	5	NIL	100%
	Water Resources Engg	26	14	12	5	1	4	54% + 20%
	Transportation Engg	35	35	NIL	5	5	NIL	100%
	Geoinformatics	20	12	08	5	3	2	60% + 60%
	Environmental Engg	34	31	03	5	2	3	91% + 40%
	Construction Tech & Management	35	35	NIL	5	4	1	100%+80%
	Geotechnical Engg.	35	33	02	5	3	2	94% + 60%
EE	Power Systems Engg	30	29	01	5	5	NIL	97%+100%
	Power Electronics & Drives	30	30	NIL	5	5	NIL	100%
	Smart Electric Grid	25	25	NIL	5	5	NIL	100%
	Control & Automation	20	17	03-01=02	5	6	NIL	90%+100%
ME	Thermal Engineering	25	23	02	5	5	NIL	92%+100%
	Automobile Engg.	25	22	03	5	5	NIL	88%+100%
	Machine Design	30	29	01-01=00	5	6	NIL	100%
	Manufacturing Engg.	30	28	02	5	5	NIL	93%+100%
	C I M	23	20	03	5	3	2	87%+60%
EC	ACS	30	30	NIL	5	5	NIL	100%
	E & MLS	26	26	NIL	5	5	NIL	100%
	VLSI System Design	24	24	NIL	5	5	NIL	100%

MM	Materials Technology	20	NIL	20	5	NIL	5	0%
	W T & NDT	20	NIL	20	5	NIL	5	0%
CH	Chemical Engg.	20	NIL	20	5	4	1	0%+80%
	SEG&ST	20	10	10	5	2	3	50%+40%
CS	CSE	25	25	NIL	5	5	NIL	100%
	CS & IS	25	25	NIL	5	5	NIL	100%
BT	Biotechnology	20	18	02	5	4	1	90%+80%
	FINAL	**688**	**576**	**110 +2 (SF)**	**130**	**101**	**29**	

PG Admissions

Department	Specialization	Sanctioned Strength	Seats Filled	No. of Vacancies	Percentage of seats filled
MA	M.Sc. in AM	30	27	03	90%
	M.Sc. in M & SC	30	30	NIL	100%
PH	M.Sc. (Tech)	60	54	06	90%
CY	MSc. Chemistry	60	53	07	88%
MS	MBA	77	66	11	86%
CS	MCA	58	57	01	98%

In view of no admissions in to two M.Tech programs of MM Dept., namely Materials Technology and Welding Technology and Non-destructive Testing, the Chairman, Senate suggested the following.

- *The MTech in Materials Technology can be renamed with consultation of some leading industries.*
- *The said M.Tech program can be offered as an interdisciplinary program with industrial significance by establishing a Centre for Manufacturing and Materials. This Centre is to run by involving faculty members from MM, ME, PH and CS departments.*
- *Further, the other M.Tech program in Welding Technology and Non-destructive may be discontinued with a provision of offering M.Tech by Research. These MTech by Research students may be given option to convert to PhD programme.*

The Senate requested Prof. DVSS Siva Sarma, Chairman, New Programs Committee to suggest the modalities for implementing the above proposal.

2024-137-Senate-12	Policy for Comprehensive Viva-Voce exam for Scholars

The proposed comprehensive Viva-Voce Policy is as given below:

- The Supervisor has to choose a Coordinator (may be a member of the DSC) for the conduct of the written exam
- The coordinator with the help of other faculty members will have to set the question paper and complete evaluation

The Senate suggested that the Chairman, Doctoral Scrutiny Committee may be entrusted with the responsibility for conducting the Comprehensive Viva Voce Examination.

2024-137-Senate-13	Guidelines for Change of Supervisor

There are no guidelines for Change of Supervisor in the present regulations. Of late, a number of Scholars are making requests for change of supervisor, citing some irrelevant and sometimes baseless accusations on the Supervisor.

The Senate suggested that the issue may be referred to Research Progress Evaluation Committee for suggesting guidelines for discussion in the next Senate.

2024-137-Senate-14	Review of PhD Scholar's Progress

The proposals for reviewing the progress of the Scholars are given below:

- The Scholar is to be assigned with 20 research credits per semester. Every Scholar has to get a minimum of 120 research credits with Satisfactory grade, which is awarded solely by the Supervisor
- Each Semester Progress review carries 10 credits, which is to be evaluated by the DSC as Satisfactory or not satisfactory. Every Scholar has to get a minimum of 60 such credits
- The Scholar may be waived of Course work requirements based on the credits earned by the student previously.
- The above credits are in addition to the Course work credits earned by the Scholar.

The above proposal is approved by the Senate.

2024-137-Senate-15	Policy for issuing Minor and Honors Certificates

Students who have registered for Minor Specializations and Honors Programs, graduating in 2025 have to be issued with the relevant certificates. As these certificates are being issued for the first time, the following proposals/issues are placed before the Senate:

- The Provisional and Degree Certificates may be modified to include: degree in "name of the discipline" with Honor/Minor specialization in "name of the Honor/Minor specialization".
- The Minors and Honors courses completed by the student may be issued as a separate Grade sheet after completion of Honors/Minor Specialization.
- CGPA may be calculated separately for Honor/Minor Specialization and mentioned in the Grade Sheet.
- Award of certificate for partial completion of courses in Honor/Minor Specialization?

The above proposal is approved by the Senate with the suggestion that for students who have partially completed the requirements, the Grade sheet will be provided for all the registered courses at the end of the Program.

2024-137-Senate-16	Proposal to start a New Academic Department

In view of difficulties in achieving a good student and faculty ratio and running multiple programmes with less faculty, there is a need of transferring some of the academic programs such as MCA and BTech in Match & Computing to an Exclusive Department. It is proposed to work out for establishing a New Department called Engineering Computations and Applications. This new department may offer B.Tech in Math and Computing and MCA including interdisciplinary programs to be proposed by CE, ME and CH Departments.

The Senate in principle approved the proposal to start this new Department. The Chairman, New Academic Programmes is requested to suggest modalities with involvement of Departments of MA and CS to run this new Department.

2024-137-Senate-17	**Application for Grade Change**

It is proposed to enforce the application for Grade Change through ERP by giving a cut-off date after the publication of semester results. The applications shall be processed by the respective Department through Departmental Academic Appeals Committee (DAAC). The recommendations of the DAAC involving change of grades, if any, shall be presented to the following Committee:

Director, Chairman

Dean, Academic, Member

Head of the Department, Member

Professor (I/C), Examinations, Convener

The item is deferred to the next Senate for paucity of time.

2024-137-Senate-18	**Academic Calendar for BSc. BEd. Program**

The proposed Academic Calendar for BSc. BEd. Program is placed before the Senate. As per the decision taken in this Senate, as there will be no Mid-semester examination, the mid-semester examination week is replaced by shifting the class work scheduled on Saturdays, with the approval of the Chairman, Senate.

The Senate approved the Academic Calendar.

2024-137-Senate-19	**Any other item with the permission of the Chair**

(a) Mr. Ravi Kumar K, (Roll No. 22EER2R02), a full time Research Scholar of EE has taken a semester break after the 3rd Semester based on medical reasons. The request of the Scholar for permission to appear for the Comprehensive Viva-Voce Examination is recommended by the DSC.

The Senate approved the recommendation of the Doctoral Scrutiny Committee to conduct the Comprehensive Viva-Voce Examination in 4th Semester.

(b) Cancellation of PhD Admission

S.No.	Department	Name of the Scholar	Roll No.	Mode	Supervisor
1	ME	Mr. M.S. Bharaneedharam	23MER1R08	Full-time	Prof. D. Jaya Krishna

2	ME	Mr. J. Shyamsunder	22MER2R03	Full-time	Prof. Srinagalakshmi Nammi
3	ME	Mr. Kambhampati Nagaraju	22MER2R01	Full-time	Prof. Prashanth Anand Kumar Lam

The Doctoral Scrutiny Committees of the above Scholars has recommended cancellation of admissions.

The Senate approved the Doctoral Scrutiny Committee recommendations to cancel the admission of the above Scholars.

The meeting ended with thanks to the Chair.

18/12/24

Prof. N. V. Umamahesh
Registrar (I/c) & Secretary

A.S. Babu

Prof. A. Sarath Babu
Dean, Academic

18/12/24

Prof. Bidyadhar Subudhi
Director & Chairman

National Institute of Technology Warangal, Hanamkonda • 506004

Guidelines for awarding the Honorary Doctorates and DSc in the Convocation

1. Introduction

The purpose of this report is to present the recommendations of the Committee regarding the conferment of Honorary Degrees *(Honoris* causa) and DSc *(Honoris causa).* The committee has undertaken a comprehensive review of practices in vogue from other institutions and our institutional goals and needs to develop a comprehensive policy framework.

It is a recognized practice for institutions and universities to confer honorary doctorates/ fellowships to acknowledge exemplary achievements and contributions in a particular field. By conferring the highest honour of an Honorary Doctorate or Doctor of Science *(Honoris causa)* the Institute distinguishes persons of exceptional credibility, professional reputation, and philanthropy, whose profound contributions exemplify unique and outstanding achievement in the fields of Engineering, Technology, Science, Business or through service to the society that reflects and represent the values of the Institute. Both types of honorary degrees under consideration acknowledge exceptional achievements and contributions but have different focuses and uses.

Honorary Doctorate *(Honoris Causa):* An honorary doctorate can be awarded to recognize general contributions to society, or in any field of study or contribution across disciplines and is not restricted to scientific fields. It is considered a broad category that includes various specific honorary degrees like Doctor of Letters (DLitt), Doctor of Laws (LLD), and Doctor of Science (DSc). It is typically awarded to individuals who have made significant contributions to society, such as in arts, philanthropy, business, politics, or community service including sciences.

DSc *Honoris Causa:* The DSc Honoris Causa is a specific type of honorary doctorate awarded to individuals who have made outstanding contributions to scientific research, significant advancements, or education. It is focused on and restricted to contributions in scientific fields such as engineering, technology, science or physics, chemistry, biology, and medicine.

The Committee has also come across the idea of awarding honorary fellowships. This practice in India, as in other parts of the world, provides a way for institutions to acknowledge and celebrate a broader range of achievements and contributions, honouring individuals whose work has had a meaningful impact even if it may not meet the criteria for an honorary doctorate. The committee recommends consideration of provision for the award of honorary fellowship by recognizing an important and sizable segment of individuals contributing their mite for betterment, though in a smaller arena, with potential for exemplary contributions in the future.

2. Objectives of Honorary Degrees

The National Institute of Technology Warangal envisions itself as a hub of excellence, striving to develop innovative, ethical, and entrepreneurial professionals who can thrive in a challenging environment, by providing high-quality education and fostering a collaborative environment where stakeholders can benefit from shared experiences and knowledge that meets societal needs and contributes to wealth creation. With this, the Institute set forth the vision and mission highlighting the institute's commitment to excellence, innovation, and societal contribution:

Vision

Towards a Global Knowledge Hub, striving continuously in pursuit of excellence in Education, Research, Entrepreneurship, and Technological services to the society.

Mission

- Imparting total quality education to develop innovative, entrepreneurial, and ethical future professionals fit for globally competitive environment.
- Allowing stakeholders to share our reservoir of experience in education and knowledge for mutual enrichment in the field of technical education.
- Fostering product oriented research for establishing a self-sustaining and wealth creating center to serve the societal needs.

In line with the above, the conferment of honorary degrees at NITW aims to achieve the following objectives:

- Recognize and honour individuals who have made significant contributions to society, particularly in the fields of engineering, technology, science, and industry.
- Inspire students, faculty, and the broader community by acknowledging exemplary achievements and leadership.
- Foster connections and collaborations with distinguished individuals of a standing that can drive our reputation by bringing them into NITW community to become our ambassadors.
- Enhance the prestige, reputation, and visibility of the National Institute of Technology Warangal (NITW) through association with distinguished individuals.

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3. Criteria for Conferment

Achievements of national or international significance deserve priority consideration. As honorary degrees carry the endorsement of the Institute in recognition of the achievements and contributions benefitting the society, nation, and humanity at large, the recipients must be persons of sustained reputation, great integrity, and moral values as the choices we make reflect our values as an institution. The Institute should focus on a compelling reason why it should confer its highest honour on an individual at a particular time.

The institution should enhance the value and impact of its honorary recognitions, by strengthening its reputation and the prestige of the awards it confers. Awarding honorary degrees to highly respected and accomplished individuals enhances the institution's prestige and credibility also giving visibility to the institution. The conferment of the honorary degree often takes place during a formal significant academic ceremony like the convocation, where the recipient is presented with a citation, certificate, or medal. The single most important criterion for selection for an honorary degree is a level of excellence or exceptionality that the recipient has shown in one or more fields.

The committee recommends the following criteria for the conferment of honorary degrees of Honorary Degree (Honoris causa) and DSc (Honoris causa):

I. Honorary Doctorates *(Honoris* causa):

The individual must have had a distinguished career in their field of expertise, with significant contributions to society, industry, or academia demonstrating exceptional achievement and leadership. The individual should have a demonstrated influence

and impact on their field or society at large. The parameters for consideration may be:

- **Distinguished Contributions:** The individual should have a demonstrated influence and impact on their field or society at large. The individual must have had a distinguished career in their field of expertise, demonstrating exceptional achievement and leadership with distinguished contributions to a field of study or professional practice in research, innovation, industry, or significant contributions to society, such as in business, arts, philanthropy, community service, or politics.

  The honorary doctorate is not restricted to scientific fields and can be awarded across disciplines. The individual should have made significant contributions to society, industry, or academia.

- **Professional Achievements:** Outstanding professional accomplishments recognized by peers and professional bodies.

- **Educational Impact:** Contributions to the advancement or promotion of education and knowledge dissemination in relevant fields.

- **Community and Public Service:** Efforts in public policy, community service, and advocacy for social good. Leadership and impact in public service or community engagement.

II. D.Sc. *(Honoris* causa):

This honour is done to individuals who have made outstanding contributions to scientific research, advancements, or education The individuals who have a demonstrated influence and impact on their field or society at large with their Groundbreaking research, exceptional contributions to scientific knowledge, significant advancements, or achievements in engineering, technology, and science by adherence to high ethical standards in scientific research and practice. The parameters for consideration may be:

- **Research Excellence:** Pioneering research and significant contributions to science and technology with substantial impact in scientific fields.

- **Innovation and Invention:** Development of groundbreaking technologies or methodologies.

- **Academic Leadership:** Leadership in major scientific or engineering projects with continuous contribution to intellectual property and high-quality peer-reviewed publications.

- **Global Influence:** Contributions to global standards, collaborations, and scientific bodies.

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4. Nomination and Selection Process

The Search and Selection Process will be entrusted to a Committee nominated by the Chairman, Senate.

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5. Frequency and Number of Awards

Honorary degrees (Honorary Doctorates, DSc honoris causa, and Honorary Fellowships) are typically conferred during a significant academic event like convocation. The institution should enhance the value and impact of its honorary recognitions, by strengthening its

reputation and the prestige of the awards it confers. It is not necessary to award honorary degrees every year. Awarding these honours only when truly deserving candidates are identified helps to maintain their value and prestige. The Committee considering that frequent and numerous awards can dilute the value of the honours, making them seem less exclusive and prestigious, makes the following recommendations:

a) **Frequency:** Award of honorary degree should be based on merit only when truly deserving candidates are available rather than adhering to a fixed annual schedule. It is not necessary to award honorary degrees every year. Focusing on the quality and impact of the recipients rather than adhering to a strict annual schedule enhances the significance of the awards.

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6. Implementation and Review

The committee suggests the following steps for implementation and periodic review:

a) **Implementation:** Develop detailed guidelines and forms for the nomination and selection process.

b) **Ethical Standards and Integrity:** Ethical standards and integrity of the process prestige, reputation

c) **Review:** Conduct a periodic review of the policy and its effectiveness, making adjustments as needed.

d) **Recognition:** Effort is to be made to recognize nominees who have gained distinction worthy of recognition extending well beyond their field of endeavor and geographical area of activity. Normally, not more than one honorary degree will be conferred at any convocation ceremony. When awarding honorary degrees, normally it is more common to recognize the achievements of the individual to date/ current. Awarding of an honorary degree should be well before the end of a career, while the accomplishments are recent and the activities worthy of highest commendations.

e) **Balance:** A balance should be kept between various fields of endeavor. Honorary degree selection shall not be based upon financial or political considerations.

f) **Lapsing of offer:** The invitations are not intended to be open-ended. Candidates are expected to communicate their acceptance of the institute's offer within a stipulated period of not less than FOUR- weeks to attend the convocation ceremony for the conferral of the honorary degree in person.

g) **Acceptance Speech:** The recipient of the honorary degree is to convey the written text of the acceptance speech to be delivered by the person at the time of conferring the honorary degree.

h) **Honorary degrees/fellowships are not conferred posthumously.**

i) **Withdrawal:** The Institute reserves the right to withdraw an Honorary Degree if the behavior or actions after the person is awarded brings disrepute to the Institute. A recommendation for the withdrawal of an honorary degree is brought forward to the Board of Governors upon the recommendation of the Senate based on a clear source of evidence with reasonable certainty. The recommendation of the Senate must have the support of at least three-fourths majority.

j) **Confidentiality:** Nominations made to and the deliberations on Honorary Degrees must be held in strict confidence. The names of those nominees ever made known to

the public are the ones who were offered and accepted an honorary degree, following the decision of the Board of Governors.

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7. Conclusion

The Committee believes that this report will lead to a policy on the conferment of Honorary Degrees (honoris causa) and D.Sc. (honoris causa) and provide a framework for the same. Conferment of honorary degrees (honoris causa) and DSc (honoris causa), aligning with the institution's vision, mission and values are seen as steps to enhance the prestige of the Institution by honouring deserving individuals, and inspire the institution's stakeholders and community. We submit this report for consideration and approval by the competent authority.

Suggestive Criteria for Conferring Honorary Recognitions

When identifying accomplished individuals for honorary recognitions, it is essential to establish clear and comprehensive criteria that reflect the institution's values and mission. The basic criteria sought pertains to (i) Professional Accomplishments (academic and industry accomplishments with sustained achievements of distinction), and (ii) Commitment to serve (Contributions to the nation and impact on humanity- transformational, influential and innovative leadership with demonstrated commitment to benefit the society). Here are detailed suggestive criteria for conferring (i) Honorary Doctorates Honoris Causa, (ii) DSc Honoris Causa, and (iii) Honorary Fellowships. Over a period of time, the institute should seek to achieve a balance across disciplines and backgrounds. A structured approach is expected to help in maintaining the prestige and significance of the honours conferred.

Some leading questions which can guide the committee in its deliberations for short listing the nominees:

a) In what ways is this nominee's achievement truly outstanding?

b) In what ways has scholarship, a profession, or some significant segment of society benefitted by this contribution?

c) Will this person's achievement be seen to be important and exemplary to the students who will graduate at the current convocation?

d) Has this person been appropriately recognized by the field or profession in which they are said to excel?

e) Why is it appropriate for NITW to honour this person at this time?

f) Does this candidate help NITW achieve the goal of reflecting, in the honours it bestows, the academic diversity of the Institute?

To identify individuals for honorary recognitions based on their exemplary and significant contributions to the society, liberal arts, industry, public or community service, and their demonstrated influence and impact on their field of activity, following aspects may be considered to arrive at specific criteria:

(i) Honorary Doctorates Honoris Causa

General Criteria:

1. **Distinguished Career:** The individual must have had a distinguished career in their field of expertise, demonstrating exceptional achievement and leadership.
2. **Significant Contributions:** The individual should have made significant contributions to society, industry, or academia - Significant philanthropic contributions and initiatives that led to positive impact on society.
3. **Public Service:** Contributions to public service, including involvement in non-profit organizations, government, or community service.
4. **Influence and Impact:** The individual should have a demonstrated influence and impact on their field or society at large.

Specific Criteria:

1. **Innovative Work:** Recognition for pioneering work or innovation in the development of groundbreaking theories, methods, or works benefitting the society through appropriate technologies and processes, social and cultural activities or related fields. Development and implementation of innovative solutions to scientific and social challenges.
2. **Academic and Artistic Excellence:** Receiving major national or international awards, grants for contributions to the advancement of training, education, including curriculum development, research, and mentorship in areas of liberal arts, appropriate technologies and social wellbeing, etc.
3. **Publications and Educational Impact:** Authoring influential books, articles, or creative works having significant scholarly or public impact. Staging notable exhibitions, performances that garnered critical acclaim and public attention.
4. **Advocacy and Global Recognition:** Active promotion and advocacy for the importance of the liberal arts in society. International recognition through awards, honours, or leadership in global organizations.

(ii) DSc Honoris Causa

In addition to the criteria mentioned above in a general form and fields of activity and specialization for Honorary Doctorate, the parameters are *very* relevant to the award of DSc *Honoris causa* but with reference to engineering, technology, science and industry. The following may be gainfully considered:

General Criteria:

1. **Outstanding Scientific Achievement:** Exceptional contributions to scientific knowledge and research. Major innovations in products, services, or processes that have transformed the industry.
2. **Academic Leadership:** Leadership in academic institutions or professional scientific organizations.
3. **Research Excellence:** A record of groundbreaking and high-impact research.
4. **Ethical Standards:** Adherence to high ethical standards in scientific research and practice. Significant contributions to job creation

Specific Criteria:

1. **Scientific Publications:** A significant number of high-impact publications in peer-reviewed scientific journals.
2. **Research Funding:** Successful acquisition and management of significant research funding and grants.
3. **Scientific Innovation:** Development of new theories, methodologies, or technologies in science and engineering.
4. **Mentorship:** Demonstrated commitment to mentoring young scientists and researchers.

Guidelines for Preparation of Thesis

राष्ट्रीय प्रौद्योगिकी संस्थान वारांगल

National Institute of Technology Warangal

Hanamkonda, Warangal-506004, Telangana

PREPARATION OF A THESIS

Contents:

Preparation of the Synopsis

1. General Instructions

1.1 Limit the total number of pages of a synopsis, excluding the title page, to 10.

1.2 Use A4-size paper.

1.3 Give a one-inch margin at the top and the bottom, and on both sides of each page.

1.4 Give a copy of the synopsis to each of the DSC members at least two days before the scheduled date of synopsis seminar.

1.5 After the seminar, modify the synopsis incorporating the suggestions made by the DSC members. Give a copy of the modified synopsis to each of the DSC members for comments.

1.6 After the modified synopsis is approved by the DSC members, get the signatures of the DSC members on one copy of the synopsis. Submit this copy, along with a soft copy of the synopsis on a CD, to the Academic Section.

2. Title of the Thesis

2.1 The title of a thesis should be a meaningful description of the work done by the scholar.

2.2 It should be short without exceeding 20 words.

2.3 Avoid words that serve no useful purpose in the Title. Redundant words, such as "An investigation of …..", "A Study of …..", "Theory of …." " Some ….", "An Experimental Investigation of …", and "Toward a ….", should be avoided.

2.4 Thesis titles should not contain formulas, symbols, subscripts, Greek letters, or other non-alphabetical symbols. Word substitutes should be used instead. For example, a title "The Effects of Ion Implantation and Annealing on the Properties of $TiSi_2$ Films on Silicon Substrates" should be written as "The Effects of Ion Implantation and Annealing on the Properties of Titanium Silicide Films on Silicon Substrates."

2.5 Thesis titles should not contain acronyms or even acronyms in brackets. For example, "GPS" should be written as "Global Positioning System" and should not be written as "Global Positioning System (GPS)."

3. Title Page

3.1 The title page must contain the title of the thesis, the degree of Doctor of Philosophy, the name of the scholar, the name(s) of the supervisor(s), the department where the scholar is registered, the logo of the Institute, the name of the Institute, and the month and year of submission of the synopsis.

3.2 Prepare the page in MS Word Times New Roman (or LaTex) with font sizes indicated on the sample page given at the end of this document. Center the text on the page. Give one-inch margin on the top and the bottom and in each side of the page.

3.3 A sample title page is illustrated on page 7.

4. Body of the Synopsis

4.1 The body of the synopsis should have the following sections: Introduction, Literature survey, Objectives and Scope, Work done on each objective, Conclusions, Contributions made by the scholar, and References.

4.2 No appendix need be given in the synopsis.

4.3 Use MS Word Times New Roman (or LaTex) with font size 12 and 1.5 line spacing for the text.

4.4 References should be single-spaced.

4.5 Sections will be numbered 1, 2, 3, etc., whereas subsections will be numbered 1.1, 1.2, 2.1, 2.2, etc.

5. Tables

5.1 Tables should be used only when absolutely necessary.

5.2 Tables should be numbered as Table 1, Table 2, etc. Table headings should be ideally of one-line length, should appear on the top of the Tables, and should be centered.

Example: **Table 1: Experimental Results**

5.3 A variable defined in a column of the Table should have its unit of measurement defined alongside it.

5.4 The text must have a reference to the Tables and should have an explanation of their contents. And, each table should appear after it is referenced in the text.

5.5 Please refer Appendix-C: Guidelines for Tables and Figures.

6. Figures

6.1 Only the most important figures should be given.

6.2 The independent variable is plotted in the horizontal axis of a figure, whereas the dependent variables are plotted in the vertical axis of the figure.

6.3 The units of measurement (if applicable) must appear alongside the names of the variables.

6.4 In case of multiple curves appearing in a figure, legends should be used to indicate the name of each variable, the curves should be distinct to be meaningful, and separate scales should be given for the variables.

6.5 Figures should be numbered as Fig. 1, Fig. 2, etc. Figure captions should be ideally of one-line length, should appear below the figures, and should be centered.

Example: **Figure 1: Effect of Variation of Voltage on Power and Current**

6.6 Figures must be referenced in the text along with discussions on the nature of variation of the dependent variables. And, each figure should appear after it is referenced in the text.

6.7 Please refer Appendix-C: Guidelines for Tables and Figures.

7. Page Numbering

The title page should not have a number printed on it. The page next to the title page should bear the page number 1. Page numbers should be printed centered at the bottom of each page.

8. References

Only the recent and the most important research papers and the scholar's own research papers, which are published in peer-reviewed journals and international conference proceedings, should be cited and listed in the references.

9. General Tips for Writing Synopsis:

9.1 Continuity of Ideas: Continuity of ideas is an important way to make the synopsis clear. Each paragraph should elaborate only one theme. If multiple themes have to be highlighted, just name them, discuss only one theme in that paragraph. The paragraphs, following it, can expand on the other themes.

9.2 A transition from one paragraph to the next paragraph should be smooth. Such a transition becomes easy if the first paragraph has a reference to the theme of the next paragraph. Alternatively, these two paragraphs could be linked to each other by a previous paragraph

9.3 Use of Verb Tenses

- Proper use of verb tenses can bring the required continuity.
- Past tense (e.g., "Mitra showed") or present tense (e.g., "Mitra has shown") is appropriate for the literature review and the description of the procedure if the discussion is made on the past events.
- Use past tense (e.g., "Sales rose at the rate of 10% per year.") to describe the results.
- Use the present tense (e.g., "The results of the experiment indicate . . .") to discuss the results and to present the conclusions.

9.4 Mathematical Symbols

- Please refer Appendix-B: Guidelines on Mathematical Materials
- SI units: Use SI units and follow the guidelines given in Appendix-A: Guidelines on International System of Units.

9.5 Indian Units of Measurement

"Lakh" is not understood by many non-Indian examiners. There are two ways to deal

with this problem. Avoid using it; express it as 100,000. Alternatively, when you "Lakh" is used for the first time, explain its equivalence to "100,000" in a footnote.

9.6 A Sample of Common Mistakes

Some words and expressions, commonly misspelled by the scholars, are the following:

Correct	Incorrect
et al.	etal, et. al, et al
whereas	where as
kWh	KWH, KWh
million tons (10^6)	MT
10 kg	10kg

9.7 The Overriding Rule

- Remember that the synopsis of a PhD thesis is a brief summary of the research work and is meant to be read by a person, who is well-known in the field of study but is unconnected with the work, to decide if he (or she) should give his (or her) consent to examine the thesis. Therefore, the text in the synopsis should be clear in its meaning.
- To ensure the clarity of presentation, the best method is to ask a friend, who is not in the area of work, to read through the synopsis. If he (or she) is confused with the writing, it means that the sentence/paragraph/synopsis should be rewritten for clarity.

Title of the Synopsis
(Bold Times New Roman 16)

Synopsis of the Thesis to be submitted in Partial Fulfillment of the Requirements for the Award of the Degree of
(Bold Times New Roman 12)

Doctor of Philosophy (Bold Times New Roman 14)

by

(Bold Times New Roman 16)

Mr/Ms. Scholar Name
(Bold Times New Roman 14)

Under the supervision of (Bold Times New Roman 12)

Prof. Supervisor I
and
Prof. Supervisor II
(Bold Times New Roman 14)

Department of NAME
National Institute of Technology Warangal

June 2024

(Bold Times New Roman 14)

PREPARATION OF A THESIS

OBJECTIVE

A thesis is a documentation of a research student's work - a record of the original research done by the student. It provides information on the student's research work to the future researchers. The Institute is committed to preserve a paper copy of the student's thesis for archiving and cataloging it in the Central Library, making it available to others for academic purpose, uploading it on to the intranet, and disseminating its abstract in both print and electronic forms.

Institute-wide standardization, readability, conformance to ethical norms, and durability are the four overriding criteria for an acceptable form of a thesis. The objective of this document is to provide a set of guidelines that help a research student to prepare the thesis to satisfy the above-mentioned criteria.

FEATURES

1. The final copy of the thesis has to contain all the modifications/corrections suggested by the examiners and the members of the Viva-Voce Board and is to be submitted after the student successfully defends the thesis in the viva-voce examination.
2. The thesis has to include a *declaration* by the student to the effect that he/she has not resorted to any unethical practice while carrying out the research work and preparing the thesis.
3. The *contribution* (to knowledge) of the research student must be explicit in the Introduction chapter of the thesis.
4. The thesis has to include a *certificate of approval*. The certificate remains unsigned at the time of initial submission of the thesis but is to be signed by the members of the Viva-Voce Board when the thesis is finally submitted after the Viva-Voce.

PRODUCTION

Thesis Size

5. A thesis should have 150 to 200 pages (not considering the prefacing materials of the thesis that are paginated in small Roman numerals; see the section on Page Numbering).

Tips to reduce the size of the thesis

- Use single line spacing for certain types of text (See the section on Line Spacing).
- Do not unnecessarily repeat definitions and text.
- Be precise in your description, conclusions, and interpretations.
- Do not leave blank space on a page after a table or a figure; fill it with some text.
- Do not give all the data in the thesis in tabular form. Give only sample data, a summary of data, and a graphical presentation of the main trendand fluctuation of the data, and include a CD, containing all the data, in a closed pocket at the inner side of the back page of the thesis (see the section on Non-Paper Material).
- Do not give the complete computer program listing; describe its flow of logic and its other distinguishing features instead. Include a CD, containing the program listing, in a closed pocket at the inner side of the back page of the thesis (see the section on Non-Paper Material).

Paper Quality

6. If the thesis is printed on both sides, the paper should be sufficiently thick to be opaque enough so that while reading, the print on the backside should not be visible in normal lighting conditions.

Paper Size

7. The standard size of paper of a thesis is A 4 (21.5 cm (8½ inch) wide and 28 cm(11 inch) long).
8. Oversized figures and tables, if any, should be reduced to fit with the size of the thesis but the reduction should not be so drastic as to impair the clarity of their contents. One may also fold these pages to fit with the thesis size.

Single-Sided vs. Double-Sided Printing

9. The copies of the thesis at the time of initial submission to the Institute should be printed on both sides.
10. Often, in a double-sided thesis, a figure appears on one side of a sheet of paper with its back side kept blank.
11. In a double-sided thesis, a new chapter always starts on an odd-numbered page. Therefore, if a chapter ends on an odd-numbered page, its back side has to be kept blank so that the next chapter can start on an odd-numbered page.

Non-Paper Material

12. Digital or magnetic materials, such as CDs and DVDs, may be included in the thesis. They have to be given in a closed pocket in the back cover page of the thesis. It should be borne in mind that their formats may become obsolete due to rapid

change in technology, making it impossible for the Central Library toguarantee their preservation and use.

13. All non-paper materials, as above, must have a label each indicating the name of the student, the date of submission, and the copyright notice.

Page Numbering

14. Page numbers for the prefacing materials of the thesis shall be in small Roman numerals and should be centered at the bottom of the pages.
15. Page numbers for the body of the thesis should be in Arabic numerals and should be centered at the bottom of the pages. The pagination should start with the first page of Chapter 1 and should continue throughout the text (including tables, figures, and appendices).
16. In a double-sided thesis, each side of a sheet of paper should be counted as a page, even if the back side of a sheet of paper is blank.
17. In a double-sided thesis, the odd-numbered pages are always on the right and even-numbered pages are always on the left.

Binding

18. The initial copies of the thesis submitted for examination have to be softbound and printed on both sides.

    The final approved copies of the thesis, after the incorporation of the Examiners' comments, if any, are to be submitted after the viva-voce examination. They have to be hardbound and printed on both sides of the paper. These copies should have, ontheir spines, the abbreviated title of the thesis, the name of the scholar, and the year of submission of the final version of the thesis.

FORMAT FOR THE THESIS

The following guidelines are provided to format the thesis for easy readability.

Font

19. The preferred font size of the text in the thesis is 12 point, but in no case should it be less than 11-point. The minimum font size of materials within a table or a figure can be 8 point, however.
20. The preferred font type is Times New Roman.

Margins

21. A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the thesis, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

Line Spacing

22. The line spacing in the main text must be between one-and-a-half and two. Single line spacing should be given for quotations, abstract, declaration, thesis approval, figure captions, table titles, figure legends, footnotes, and references.
23. The equations, tables, figures, and quotations should be set off from the main text

with adequate space (not less than the normal line spacing adopted for the main text).

24. Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

THE PREFERATORY MATERIALS

Title of the Thesis

25. The title of the thesis should remain same as that given in the synopsis. If it has to be changed then the consent of the DSC and the permission of the Dean (Academic) are required prior to the submission of the thesis.
26. After the submission of the final copies of the thesis, researchers around the world can have electronic access to the abstract of a thesis (internationally) and to the thesis (locally through the intranet). Search engines use the words of the title (and other keywords) to locate their contents. Use of formulas, symbols, Greek letters, etc., should be substituted by their word equivalents, because they do not appear on most computer keyboards.

Cover and First Inner Page

27. Cover page and first inner page should contain the title of the thesis and the name of the candidate. This page will also contains the name of the degree for which the thesis is submitted, the name of the Institute, month and year of submission of the thesis. In the copies of the thesis that are submitted to the Institute, the cover page should not contain any other figure, map, equation, or drawing.

See Sample Page 1 (Page No. 14) or details.

28. The spine of the thesis (when finally submitted after the Viva-Voce Examination) should be provided with an abbreviated title of the thesis, the name of the scholar, and the year of submission of the final copy of the thesis.

Approval of the Viva-Voce Board

29. Each final copy of the thesis should have a page for certificate of approval bearing the original signatures of the members of the viva-voce board (the supervisor(s), the members of the DSC, and the external examiner). This page remains unsigned in the copy to be submitted initially.

See Sample Page 2 (Page No. 15) for details.

Certificate by the Supervisor(s)

30. Supervisors certify that the thesis is a record of bona fide work done under their supervision and that they consider the work worthy of submission to the Institute for the award of the degree of PhD.

See Sample Page 3 (Page No. 16) for details.

In case of two supervisors hailing from two different academic units or from two

organizations (including one from the Institute), the letterhead will be of the department where the student is registered.

Declaration by the Student

31. The student has to give a declaration to the effect that the data used for the work, the work depicted in the thesis, and the written material contained in the thesis are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

See Sample Page 4 (Page No. 17) for details.

Acknowledgements

32. Acknowledgements should be limited preferably to one page.

Contents

33. Prefatory materials, chapter numbers, chapter names, section numbers, section headings, subsection numbers, and subsection headings, along with the corresponding page numbers, should be given in the Contents.

See Sample Page 5 (Page No. 18) for details.

List of Symbols and Abbreviations

34. All the symbols and abbreviations used in the thesis are to be given here along with their definitions and units of measurement (if applicable) and full forms.

Abstract

35. The abstract of the thesis should be limited to 350 words (a requirement for its inclusion in the Dissertation Abstracts International).
36. A list of keywords should follow the abstract.

BODY OF THE THESIS

37. The thesis should be written in either British or American English, not in a mixed mode. However, because of increasing acceptance of both styles and blurring of the distinction between the two, what is important is that consistency should be maintained all throughout the text.
38. Each chapter should be numbered in Arabic numerals and should be written as Chapter 1, Chapter 2, etc., and should be followed by its title (e.g., Introduction, etc.). The chapter title shall be printed bold and in 14-point font. Figures, tables, graphs shall be positioned within the body of the text immediatelyafter citation and should not be positioned separately. Please refer Appendix-C: Guidelines for Tables and Figures.
39. Units should be in SI format. (See Appendix-A: *Guidelines on International System of Units*)

References

40. Author-date style of referencing is preferred for a PhD thesis of the Institute.

41. Individual department's guidelines may be followed alternatively.
42. Irrespective of the style adopted, the reference details must include the titles of the publications.

Appendices

43. Each appendix will be numbered (e.g., Appendix A, Appendix B, etc.).
44. It will also have a title.

Sample Page 1

THE TITLE OF THE THESIS IN THE SECOND PAGE SHALL LOOK EXACTLY LIKE THIS TITLE

(4 lines gap) - 'Times New Roman' – 12-point size – Bold – Italics - centered

Thesis submitted to the

National Institute of Technology Warangal
For award of the degree

(1 line gap) - 'Times New Roman' – 12-point size – Bold – Italics - centered

of

(1 line gap) - 'Times New Roman' – 14-point size – Bold - centered

Doctor of Philosophy

(1 line gap) - 'Times New Roman' – 12-point size – Bold – Italics - centered

by

(1 line gap) - 'Times New Roman' – 14-point size – Bold - centered

Scholar Name

(2 lines gap) - 'Times New Roman' – 12-point size – centered

Under the guidance of

(I line gap) – 'Times New Roman' – 12-point size – Bold - centered

Prof. Supervisor Name

(LOGO)

(1 line gap) - 'Times New Roman' – 14-point size – Bold - centered

DEPARTMENT OF XXXXXXXXXXXXX

NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL
JUNE 2024

Sample Page 2

APPROVAL OF THE VIVA-VOCE BOARD

DD/MM/YR

Certified that the thesis entitled THE TITLE OF THE THESIS submitted by NAME OF THE STUDENT to the National Institute of Technology, Warangal, for the award of the degree Doctor of Philosophy has been accepted by the external examiners and that the student has successfully defended the thesis in the viva-voce examination held today.

(Member of the DSC) (Member of the DSC) (Member of the DSC)

(Supervisor) (Co-Supervisor)

(External Examiner) (Chairman, DSC)

Sample Page 3

(The certificate is to be printed on the Departmental Letter-Head)

CERTIFICATE

This is to certify that the thesis entitled **The Title of the Thesis**, submitted by **The Name of the Scholar** to National Institute of Technology Warangal, is a record of bona fide research work under my (our) supervision and we consider it worthy of consideration for the award of the degree of Doctor of Philosophy of the Institute.

_____ _____

Supervisor Co-Supervisor

Date:

Sample Page 4

DECLARATION

I certify that

a. The work contained in the thesis is original and has been done by myself under the general supervision of my supervisor(s).
b. The work has not been submitted to any other Institute for any degree or diploma.
c. I have followed the guidelines provided by the Institute in writing the thesis.
d. Whenever I have used materials (data, theoretical analysis, and text) from other sources, I have given due credit to them by citing them in the text of the thesis and giving their details in the references.
e. Whenever I have quoted written materials from other sources, I have put them under quotation marks and given due credit to the sources by citing them and giving required details in the references.

Signature of the Student

Sample Page 5

CONTENTS

Appendix-A

GUIDELIES ON INTERNATIONAL SYSTEM OF UNITS

Use SI units in the thesis unless one has compelling reasons to use non-SI units.

The SI units consist of

(a) seven *base units*,

(b) a set of *prefixes*, and

(c) several *derived units*

The SI units follow a standard *writing style*.

The SI Base Units

The *SI base units* represent seven mutually independent *base quantities.* These quantities, their names, and the symbols that represent them are given in Table 1.

The Prefixes

A prefix may be added to any unit to produce an integer multiple of ten of the base unit. For example, a kilogram denotes a multiple of one thousand of a gram and a milligram denotes a multiple of a thousandth of a gram. Table 2 gives the prefixes that are accepted to be used in the SI units. Prefixes are never combined. For example, millimillimeter is not written; micrometer is written instead.

Table 1: The SI Base Units

Quantity	Name	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	Cd

Table 2: The SI Prefixes

Name	yotta-	zetta-	exa-	peta-	tera-	giga-	mega-	kilo-	hecto-	deca-
Symbol	Y	Z	E	P	T	G	M	K	h	da
Factor	10^{24}	10^{21}	10^{18}	10^{15}	10^{12}	10^{9}	10^{6}	10^{3}	10^{2}	10^{1}
Name	deci-	centi-	milli-	micro-	nano-	pico-	femto-	Atto-	zepta-	yacto-
Symbol	d	C	M	μ	n	p	f	A	z	y
Factor	10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}	10^{-18}	10^{-21}	10^{-24}

The SI Derived Units

A system of equations involving the seven base quantities defines the *derived quantities*. The *SI derived units* follow these equations to represent the derived quantities. Table 3 gives examples of a number of SI derived units.

Table 3: Examples of SI Derived Units

Derived quantity	**Name**	**Symbol**
Area	square meter	m^2
Volume	cubic meter	m^3
wave number	reciprocal meter	m^{-1}
mass density	kilogram per cubic meter	kg/m^3
specific volume	cubic meter per kilogram	m^3/kg
mass fraction	kilogram per kilogram, which may be represented by the number 1	kg/kg = 1*
speed, velocity	meter per second	m/s
Acceleration	meter per second squared	m/s^2
current density	ampere per square meter	A/m^2
Magnetic field strength	ampere per meter	A/m
amt-of-substance concentration	mole per cubic meter	mol/m^3

Luminance	candela per square meter	cd/m^2

* The symbol 1 for quantities of dimension 1 is generally omitted.

The SI Derived Units with Special Names and Symbols

Twenty-two derived units are given special names and symbols because they are in popular use for a long time. These units (names and symbols), together with the quantities they represent, and the expressions in terms of other SI units and base units, are given in Table 4.

Table 4: SI Derived Units with Special Names and Symbols

Derived quantity	**Name**	**Symbol**	**Expression in terms of other SI units**	**Expression in terms of SI base units**
plane angle	radian	rad	-	$m \cdot m^{-1} = 1$
Solid angle	steradian	sr	-	$M^2 \cdot m^{-2} = 1$
frequency	hertz	Hz	-	s^{-1}
Force	newton	N	-	$m \cdot kg \cdot s^{-2}$
pressure, stress	pascal	Pa	N/m^2	$m^{-1} \cdot kg \cdot s^{-2}$
energy, work, quantity of heat	joule	J	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
power, radiant flux	watt	W	J/s	$m^2 \cdot kg \cdot s^{-3}$
electric charge, quantity of electricity	coulomb	C	-	$s \cdot A$
electric potential difference, electromotive force	volt	V	W/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
capacitance	farad	F	C/V	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$

electric resistance	ohm	Ω	V/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
Electric	siemens	S	A/V	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
conductance				
Magnetic flux	weber	Wb	V·s	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
magnetic flux density	tesla	T	Wb/m^2	$kg \cdot s^{-2} \cdot A^{-1}$
Inductance	henry	H	Wb/A	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
Celsius temperature	degree Celsius	°C	-	K
luminous flux	lumen	Lm	cd·sr (c)	$m^2 \cdot m^{-2} \cdot cd = cd$
Illuminance	lux	Lx	Lm/m^2	$m^2 \cdot m^{-4} \cdot cd = m^2 \cdot cd$
activity (of a radionuclide)	becquerel	Bq	-	s^{-1}
Absorbed dose, specific energy (imparted), kerma	gray	Gy	J/kg	$m^2 \cdot s^{-2}$
Dose equivalent	sievert	Sv	J/kg	$m^2 \cdot s^{-2}$
Catalytic activity	katal	kat	-	$s^{-1} \cdot mol$

The SI Writing Style

The writing style for the SI units has been standardized. It is detailed below.

- Names of units are always written in lower case; their symbols are also written in lower case unless they are derived from names of specific persons.

  Example:

Quantity	**Name**	**Symbol**	**Explanation**
mass	kilogram	kg	-

thermodynamic temperature	kelvin	K	Named after Lord Kelvin
pressure	pascal	Pa	Named after Blaise Pascal

Exception to the rule:

The Celsius temperature has the accepted name "degree Celsius" although it is named after the scientist Celsius, not "degree celsius".

- A space separates the number and its symbol.
  Examples: 25 kg, $3.2x10^{-2}$ m^3, 100 °C, and 300 K

Exception:

- No space separates the symbols for plane angular degrees (°), minutes (’), and seconds (’’) from the numbers they follow.

  Examples: 10°, 5’, and 10’’.

- A symbol is not followed by a period unless it appears at the end of a sentence.
  Example:
  25 kg. - Incorrect
  25 kg - Correct

- Symbols are not pluralized.
  Example:
  25 kgs - Incorrect
  25 kg - Correct

- Names of units are pluralized, whenever needed.

  Examples: 25 kilograms and five millimeters

  Exceptions:
  The units lux, hertz, and siemens do not change their form in plural.

- A symbol is not italicized; it is written in upright Roman letters (such as "m" for meter and "s" for second) to distinguish them from italicized Roman letters used for mathematical variables (such as *m* for mass and *s* per specific gravity).

  Example:
  25 *kg* - Incorrect
  25 kg - Correct

- Symbols for derived units formed by the product of multiple units are followed by either a space or a *center dot* (also called *raised dot*) separating individual unit symbols.

  Note: The center dot has to be selected from the list of symbols.
  Examples: N m or N·m, kg s or kg·s

- Symbols for derived units formed by division of two units are separated by a solidus (/) or indicated by a negative exponent or are represented by a fraction.

  Examples: m/s^2, $m\ s^{-2}$, $m \cdot s^{-2}$, or $\frac{m}{s^2}$

- While using both multiplication and division, use the above rules and ensure that there is no ambiguity in its interpretation.

  Examples: $kg \cdot s^{-2} \cdot A^{-1}$ not $kg/s^2 \cdot A$

  $kgm^{-1} \cdot s^{-2}$ or $kg/(m \cdot s^2)$ not $kg/m \cdot s^2$

- SI derived units may be used in conjunction with other derived units to denote other SI derived units (Table 5).

Table 5: Other SI Derived Units

Derived quantity	Name	Symbol
dynamic viscosity	pascal second	Pa·s
moment of force	newton meter	N·m
surface tension	newton per meter	N/m
angular velocity	radian per second	rad/s
angular acceleration	radian per second squared	rad/s^2
Heat flux density, irradiance	watt per square meter	W/m^2
Heat capacity, entropy	joule per Kelvin	J/K
specific heat capacity, specific entropy	joule per kilogram Kelvin	J/(kg·K)
specific energy	joule per kilogram	J/kg
thermal conductivity	watt per meter Kelvin	W/(m·K)
energy density	joule per cubic meter	J/m^3
electric field strength	volt per meter	V/m
electric charge density	coulomb per cubic meter	C/m^3
electric flux density	coulomb per square meter	C/m^2
Permittivity	farad per meter	F/m
Permeability	henry per meter	H/m
molar energy	joule per mole	J/mol
molar entropy, molar heat capacity	joule per mole Kelvin	J/(mol·K)
exposure (x and γ rays)	coulomb per kilogram	C/kg
absorbed dose rate	gray per second	Gy/s
radiant intensity	watt per steradian	W/sr
Radiance	watt per square meter steradian	$W/(m^2 \cdot sr)$
catalytic (activity) concentration	katal per cubic meter	kat/m^3

A few non-SI units are accepted for use with the SI units. They are given in Table 6.

Table 6: Non-SI Units Accepted for Use with the SI Units

Name	Symbol	Value in SI units
minute (time)	min	1 min = 60 s
Hour	h	1 h = 60 min = 3 600 s
Day	d	1 d = 24 h = 86 400 s
degree (angle)	°	1° = (π/180) rad
minute (angle)	′	1 ′ = (1/60)° = (π /10 800) rad
second (angle)	″	1 ″ = (1/60) ′ = (π /648 000) rad
Liter	L	1 L = 1 dm^3 = 10^{-3} m^3
metric ton	t	1 t = 10^3 kg
Neper	Np	1 Np = 1
Bel	B	1 B = (1/2) ln 10 Np
electronvolt	eV	1 eV = 1.602 18 x 10^{-19} J, approximately
unified atomic mass unit	u	1 u = 1.660 54 x 10^{-27} kg, approximately
astronomical unit	ua	1 ua = 1.495 98 x 10^{11} m, approximately

A few other non-SI units are also used along with the SI units (Table 7). But acceptance of this practice is under review.

Table 7: Non-SI Units Accepted For Use with SI Units

Name	Symbol	Value in SI units
Nautical mile	No symbol	1 nautical mile = 1 852 m
Knot	No symbol	1 nautical mile per hour = (1 852/3 600) m/s
Are	a	1 a = 1 dam^2 = 10^2 m^2
Hectare	ha	1 ha = 1 hm^2 = 10^4 m^2
Bar	bar	1 bar = 0.1 MPa = 100 kPa = 1 000 hPa = 10^5 Pa
Angstrom	Å	1 Å = 0.1 nm = 10^{-10} m
Barn	b	1 b = 100 fm^2 = 10^{-28} m^2
Curie	Ci	1 Ci = 3.7 x 10^{10} Bq
Roentgen	R	1 R = 2.58 x 10^{-4} C/kg

Radian	rad	1 rad = 1 cGy = 10^{-2} Gy
Rem	rem	1 rem = 1 cSv = 10^{-2} Sv

A few notable points are made below:

- Electrical energy is often measured in kilowatt-hours (kWh) instead of megajoules.
- "calorie" is used as a heat unit indicating the amount of heat required to raise the temperature of one gram of water by one degree Celsius. And "Calorie" is used as a heat unit indicating the amount of heat required to raise the temperature of one kilogram of water by one degree Celsius. Thus: A Calorie is a kilocalorie (or large calorie).
- Blood pressure is measured in mmHg instead of Pa.
- Atomic scale units used in physics and chemistry are ångström, electron volt, atomic mass unit, and barn.
- Astronomical distances are measured in astronomical units, parsecs, and light- years.
- Travel distance and speed of ships and aircraft are measured in nautical mile and knot (nautical mile per hour).
- The year is not specifically included as an SI unit.
- Litre has a symbol L and not the lowercase letter l to distinguish it from the numeral 1. In some countries, the italicized letter *l* is also used.
- A metric ton is called "tonne" in a few countries.
- Commas are used as thousand separators in many countries, whereas periods are used for this purpose in a few European countries. To avoid this confusion, SI units prescribe spaces as thousand separators.
  Examples: 2 450 000, 45 000, 0.524 45
- It is preferred to use numbers between 0.1 and 1 000 in expressing the quantity of any SI unit. Thus the quantity 15 000 m is expressed as 15 km, and 0.002 cubic centimeter is preferably written as 2 mm^3.
- Note the following:
  - The symbol kg is a base symbol, but it has a prefix as part of its name and symbol.
  - Since multiple prefixes are not permitted, use of g is also permitted as a base symbol when prefixes are to be added.
    Thus: 10^{-6} kg = 1 mg, but not 1 μkg

- One kilobit or 1 kbit = 1 000 bit, but not equal to 2^{10} =1 024 To get over this problem, International Electrotechnical Commission (IEC) has adopted "Prefixes for Binary Multiples" for use in IT (Table 8).

Table 8: Prefixes for Binary Multiples

Derivation	Factor	Name	Symbol	Origin
kilo: $(10^3)^1$	2^{10}	kibi	Ki	kilobinary $(2^{10})^1$
mega: $(10^3)^2$	2^{20}	mebi	Mi	megabinary $(2^{10})^2$
giga: $(10^3)^3$	2^{30}	gibi	Gi	gigabinary $(2^{10})^3$
tera: $(10^3)^4$	2^{40}	tebi	Ti	terabinary $(2^{10})^4$
peta: $(10^3)^5$	2^{50}	pebi	Pi	petabinary $(2^{10})^5$
exa: $(10^3)^6$	2^{60}	exbi	Ei	exabinary $(2^{10})^6$

Thus the following equivalences hold:

one kibibit 1 Kibit = 2^{10} bit = 1 024 bit

one kilobit 1 kbit = 10^3 bit = 1 000 bit

one mebibyte 1 MiB = 2^{20} B = 1 048 576 B

one megabyte 1 MB = 10^6 B = 1 000 000 B

one gibibyte 1 GiB = 2^{30} B = 1 073 741 824 B

one gigabyte 1 GB = 10^9 B = 1 000 000 000 B

Note that the first prefix of the above symbols is borrowed from the SI convention, and the letter i is added to mean binary. To keep parity with the binary multiple prefixes, kilo is taken as K and not k (as done in SI). *Note further that these conventions are not yet accepted internationally.*

Appendix-B

GUIDELINES ON MATHEMATICAL MATERIALS

List of Symbols

A thesis should contain a list of symbols before the start of the first chapter. A list of symbols at the beginning of the thesis helps in ensuring that the same symbol is neither used for more than one purpose nor defined in more than one way. Furthermore, a reader of the thesis can refer to only one place to find the definition of a symbol.

The list of symbols should be arranged with Latin letters followed by Greek letters, each of them arranged alphabetically. Whenever applicable, the unit of measure should be given for each symbol.

Examples:

c: Velocity (km/h)
m: Mass (kg)
…
β: Regression coefficient (units/rupee)
η: Efficiency
Note the use of colon rather than the equality sign.

Numbers

Consistency

Consistency should be maintained throughout the text. The following is an example of inconsistency in writing a number 5000 in two places:

0.05×10^5 in one place and 0.5×10^4 in another

Standard Scientific Notation

Standard scientific notations are preferred to computer exponentials:

5.0×10^{-3} instead of 5.0 E−3

Decimal fractions should be preceded by zeros except in case of probabilities:

0.25 (but .25 when it refers to a probability value)

Use of the Symbol %

The symbol % is used with Arabic numbers, and the word "per cent" is used with the word version of the number:

5% and five per cent (not 5 per cent)

The symbol is not repeated with each number in a series or with each number in a range of values: 5, 10, and 15%; 5–10%

Location of a Number

A sentence shall not start with a number:

25 persons were included. (Incorrect)

Twenty-five persons were included. (Correct)

Compound Numbers

A hyphen separates the individual numbers of a compound number and also the ordinal counterparts:

twenty-one, thirty-four, . . .

twenty-first, thirty-fourth, . . .

Numbers that are nine or less should be written in words in the text. If a series of numbers contain numbers both less and more than 10, then only Arabic numerals should be used: There are 25 samples. Each sample has a size of five. Marks secured by the five students are: 2, 5, 10, 15, and 18.

Thousand Operator

For very large and very small numbers, give a space in the thousand operator:

10 000 000 0.254 25

Symbols of Basic Arithmetic Operations

The signs for the basic arithmetic operations are the following:

Plus	+
Minus	−
Multiplication	×
Division	⁄ and ÷

Excepting for the plus symbol, no symbol is available on a keyboard normally available in the market. All other symbols are to be selected from the Symbols list.

Generally there will be a confusion between the symbol of a hyphen (-) with a minus sign (−) (note the length, vertical location, and intensity of the two signs), and wrongly use the symbol of an asterisk (*) or the letter x for the symbol of multiplication (×). Similarly, do not ight when we use the symbol of a solidus (/) available on a keyboard for division (⁄) (look at the inclination of the two lines).

ISO standards for scalars, vectors, and tensors are the following:

scalar:	lightface italics (*V, l, m, ...*)
vector:	boldface italics (***V, l, m***, ...)
tensor:	lightface italics sans serif (*V, L, ...*)

The purpose of italicizing them is to distinguish them from the SI units that are always upright.

Variables and Constants

Symbols for variables, constants, and unknown quantities are to be italicized: *x, l, m*

The subscripted variables follow different writing styles:

Subscripts are numbers:	x_1, x_2
Subscripts are variables:	x_i, x_{ij}
The variables indicate constant values:	x_u, x_l

In the third example, x_u indicates the upper limit of the variable *x*, and x_l its lower limit.

Greek letters (such as α, β, etc.) are always set in Roman.

Standard Functions

Abbreviations for standard functions, such as log, max, min, exp, sin, cost, tan, cosh, lim, avg, cov, diag, and ln, are set in Roman: log *x*

Series of Variables

Three ellipses (printed like periods and separated by spaces) are to be used to indicate a series of variables: $x_1, x_2, \ldots, x_n$ (not $x_1, x_2 \ldots x_n$). Notice the commas appearing before and after the three ellipses.

Three raised ellipses (centered dots) are to be used for a series of additions or multiplications of variables:

$x_1 + x_2 + \cdots + x_n$ (not $x_1 + x_2 + \ldots x_n$)

$x_1 x_2 \cdots x_n$ (not $x_1 x_2 \ldots x_n$)

Three ellipses are to be used to indicate the range of a variable:

$x_i, i = 1, 2, \ldots$ (not $x_i, i = 1, 2 \ldots$)

Notice the presence of a comma before the first ellipsis point.

Space Accompanying Mathematical Operators

One space should be provided on both sides of a mathematical operator:

$z = x + y$

$z = x - y$

$z = x \times y$

$z = x \div y$

No space appears, however, if a division is indicated by the symbol ⁄ and also when the multiplication is implied:

$z = x/y$

$z = xy$

$z = 25x$

A negative number should not have a space separating the sign and the number:

The number −2 (not − 2) is more than −3 (not − 3).

−3 < −2 (correct); − 3 < − 2 (not correct)

Similarly, when a plus sign is used to indicate a positive number then no space appears between the sign and the number: $-3 \leq x \leq +3$

No space appears between a variable and its subscripts (or superscripts) and between a variable and its power: x_i, x_{ij}, x^2

Equations

Each equation should appear immediately after it is referenced in the text. To make it look distinct, it should be separated from the text (both preceding and following it) by a larger line spacing (compared to the one provided in the text) and should be set off from the left margin with an indentation.

All equations that are referred in the text of the thesis should be given equation numbers depending on the chapters where they appear and on the order of their appearance (same as for tables and figures). The equation numbers should be right justified and should be preceded by three raised ellipses.

It is a good practice to explain an equation in the text that precedes it, by defining the variables and their relationships that lead to the equation. An example follows:

> The number of students (z) in the class is given in eq. (4.2) as the sum of the number of male students (x) and the number of female students (y):
>
> $$z = x + y \qquad \cdots (4.2)$$

This equation is the second in order of appearance in Chapter 4.

A numbered equation should not appear in a line in the text. Thus the following is not

correct:

It thus comes out to be true that $x^2 + y = x + y^2$ · · · (4.3)

Breaking Equations

Sometimes an equation could be so long that it does not fit in one line and needs one or more additional lines to be accommodated. Such an equation can be broken in either of the two ways:

- before a verb operator (such as =, ≠, <, >, ≤, ≥, □, □, □, □) or

- before a conjunction (such as +, □, ×, □, □, □, □) that follows an aggregation (an aggregation is an expression within parentheses ( ), brackets [ ], or within curl brackets { }).

In the first case, the run-over lines are aligned on the verb operators. In the second case, the conjunction on the run-over line is lined up with the right of the verb in the line above.

Example:

$$\begin{aligned} z &= (x + y - ef + r) \\ &< 2y - ef + r \\ &\quad + e - f \end{aligned}$$

Notice that the symbol < in the second line is vertically aligned with the symbol = in the first line, and the plus sign in the third line is vertically aligned with the number 2 in the second line.

Heads and Texts for Definitions

Heads for definitions, theorems, propositions, corollaries, lemmas, assumptions, and rules are set in Roman capital and small capital, whereas the texts are in italic (except for numerals):

DEFINITION 1: *The graph . . .*
THEOREM 2:
LEMMA 4.5:
ASSUMPTION:
RULE:

Notice that the first letters of the heads are in bigger font compared to those of the succeeding letters.

Heads of proofs and solutions are in Roman capital and small capital, but the texts are in Roman, with only the variables in italic:

PROOF:
Let us assume that the variable *x* is . . .

Miscellaneous

When a mathematical expression forces one to create additional line spacing, write fractions and exponentiations as follows:

Examples: *x*/*y* and exp (*xy*)

Upper and lower limits should always be placed to the right of the integral sign, never above and below (e.g., $\int_a^b$.).

Appendix-C

GUIDELINES ON TABLES AND FIGURES

TABLE

A *table* is a group of rows and columns of numbers and/or words. A table with numerical data is more common and is known as a *statistical table*. Various guidelines for tables are as follow:

- Every table must have a title. The title appears on the top of the table. It should be short (preferably one line), clear, and self-explanatory. A subtitle, if necessary, could be given in parentheses.
- A table number (followed by a colon) precedes the title of every table.
- Number the tables with chapter numbers and Arabic numerals separated by a decimal point (e.g., 5.1). The Arabic numerals follow the order of the appearance of the tables in a particular chapter (e.g., 5.1, 5.2, etc.; 6.1, 6.2, etc.). Usually, suffix letters are not used to number tables; they are given separate table numbers (e.g., 5.1 and 5.2 instead of 5.1a and 5.2b).
- Tables in an Appendix are numbered as A1 (the first table in Appendix A), A2, B1, B2, etc.
- The word "Table" (followed by the table number, a colon, and a space) precedes the title of each table:

  Table 5.1: Population of Metropolitan Cities (in million persons)
- The entire line containing the table title and the title number is usually centered.
- The line containing the table number and the title should be in title case, with the prepositions (e.g., of, at, etc.), articles (a, an, and the), and coordinating conjunctions (e.g., or, and, etc.) in lowercase.
- Usually, every column of a table has a column heading which defines the contents of that column. Sometimes each row may have its row heading. Whenever meaningful, the units of measure must be given within parenthesis, using symbols for the units, if needed, to all column and row headings.
- Usually, the first column of a table (called a stub) contains an independent variable, other columns containing dependent variables. The stub heading is always in singular, while all other headings are in singular or plural according to the sense of the entries.
- The unit of measure of each entry in a column must be the same as indicated in the column heading. Thus a column should not contain different kinds of information; instead two or more columns should be used to convey the information.
- Center the column headings when the column entries are numerical data or even

two- or three-letter words, but left-align them if the entries are text.

- Right-align numbers in a column if they are integers. And, if the numbers contain decimal points then the numbers should be decimal-aligned.

Ex:	Correct	Incorrect	Correct	Incorrect
	345	345	23.46	23.46
	22	22	2.30	2.3

- If the entries in a column are text material and are short in length, they are centered; otherwise the text is left aligned.
- Sometimes all data in a table column are not of the same unit. In such a case they should be left justified.
- When dealing with large (or very small) numbers write, for example, $\times 10^3$ (or $\times 10^{-3}$) along the unit lines and give a footnote to explain. The footnote can be one of the following types in case the actual values are very high (or low):

  * Actual values equal reported values times 10^3.

  **Reported values equal actual values times 10^{-3}.

- Choose the level of precision to specify the values of the entriesin the column. If the whole number part of a number is very large, the decimal fraction containing many digits may not be meaningful. Conversely, if the whole number is very small, the decimal fraction containing many digits may be meaningful.

Improper	Proper
12456.235	12456.2 or 12456

- The number of digits after the decimal point should be the same for every entry in a column to reflect the same level of precision to which all the items are specified. One may add insignificant zeroes to have the same decimal places in a column.
  Example:

  23.45

  22.20 (not 22.2)

- Use standard abbreviations and standards for non-technical terms (e.g., No. for number, % for percent) and for statistics (e.g., χ^2, μ, and χ^2) in tables.
- In case a cell in a table does not have an entry (empty cell), put a dash in that cell and explain it in a general note to the table (that follows the table immediately and appears on the same page as the table).

Note: A dash is different from a hyphen and should be inserted as a symbol.

Often data, unnecessary in the context, are presented in a table. Remove such unnecessary data.

- Many standard software packages give, as output, a large number of tables. If they are included, discuss each column in each such table and highlight their significance; else do not include all of them (include only the relevant ones).

- Every table must be referred to in the text by the corresponding table number, either directly or parenthetically:

  City names and their populations are given in Table 12.1
  Each city has its own population (Table 12.1).
  Table 12.1 gives the names of cities and their populations.
- Do not refer to a table as "the table above/below" or "the table on page 45".
- Discuss, in the text, the contents of the table and their significance, and bring out hidden relationships among the variables.
- Any special point for an item (or items) of a table can be made as footnote to the table.
- If tables are reproduced from someone else's work, give the reference (inthe usual referencing style) along with the page number, as a source note and take permission of the author of the source before reproducing the table. Write "With permission from . . ." as a footnote to the table.
- Footnotes can be *source notes*, *general notes*, *specific notes*, and *probability notes.* They clarify ideas related to the table as a whole, a particular column, row,or individual entry, and to the results of tests of significance. They should appear immediately after the table on the same page as the table, should be left justified, and should appear in the following sequence: Source note, General note, Specific note, Probability note.

Source notes give details of the source of the data contained in a table; general notes may highlight some general characteristic about the nature of data/information contained in the table; specific notes expand on specific features of a column variable or a specific entry in a cell; and probability notes give the level of significance in the tests of hypotheses.

Examples:

Source: Government of India Department of Water Resources Publication, 2006.

(This is an example of source note.)

Notes:

1. The data were collected through a questionnaire survey.
2. The number of respondents was 50.

(These are examples of general note.)

[a]This value indicates the opinion of the respondents.

[b]The figure indicates the result of an analysis.

(These are examples of specific note. Note that the superscripts [a] and [b] are also given along side the corresponding figures in the table. If a table contains word entries, special symbols, such as #, †, and ‡, are used instead.)

*þ < .05. ** þ < .01.

(These are examples of probability note. Note that usually asterisks are used for probability notes, and also that because probability is always less than

or equal to 1, “0” does not appear before the decimal point.)

- A table should appear after, and close to, the text where it is first referenced.
- A table should not spill over to a second page. If it is too long, break it up into two or three different tables. In case a long table cannot be split into more than one table, the message “Continued on the next page” should appear at the foot of the page and a message (e.g., “Table 14.1–continued”) should appear on the topof the following page. Note the use of dash appearing between the table number and the word “continued” with no space either before or after the dash).

When a table extends to a second page, the source note and the general note appear on the first page, whereas the specific and the probability notes are put on the relevant pages.

- In case a table extends to a second page, the table number is not printed on the second page, but the column headings are.
- Leave at least a two-line gap before the table title and after (the footnote of) the table.
- Intersperse the table and the text on the same page; don’t leave space on a page just because a table appears there.
- Don’t leave half a page blank because the text on the page refers to a table that cannot be fitted on that page and instead appears on the next page.
- Fit the table within normal margins, if required by reducing the size.
- If a table is too wide to fit the width of a page, it may be printed in a landscape mode. When the thesis is printed on only one side of a sheet of paper, such a table should be so placed that the table heading appears towards the binding edge of the thesis making it possible for a reader to read the table from the outer edgeof the thesis.

When the thesis is printed on both sides and when the table appears on an odd- number page, it is also to be placed in the above-stated manner. However, if it appears on an even-number page, the table heading should appear towards the outer edge of the thesis.

- If a table is so wide that even when printed in the landscape mode, it cannot be fitted nicely, then try to break it up into more than one table, failing which, as the last resort, print it in the portrait or the landscape mode andfold the sheet of the paper so that it is compatible with the thesis size.
- Table titles and the words “Source” and “Notes” appearing in the footnotes are in the same font as that of the text, while the body of the table may be of less font size but should not be less than 8-point size. The font size of the text in the footnotes (except the words “Source” and “Notes”) should be one point less than that of the body of the table but should not be of less than 7-point size.

FIGURE

Any illustration other than a table is called a figure. A figure may be a chart (boxes connected with lines, pie charts), graph (line graphs, bar graphs, scatter graphs, and pictorial graphs), photograph, map, drawing, painting, or some such depiction. Whereas a table gives exact quantitative data, a figure conveys an overall pattern or concept underlying the data.

Various guidelines for figures are as follows:

- A figure should have a caption (title). A short one-line caption is desirable. The word "Figure" or the abbreviation "Fig." and the figure number (followed by a colon and a space) precede the caption. Use the chosen word consistently in both the text and the figure caption. No period appears after a figure caption.

  Figure 5.1: Probability Density Function of Population Density

  Fig. 5.1: Probability Density Function of Population Density
- Figures are numbered. The figure number follows a double-numeration system (such as Fig. 5.1) where the first number indicates the chapter number and the second number indicates the serial number of the figure in that chapter.
- Figure caption (along with figure number) appears below the figure and is usually placed symmetric to the figure.
- Define all abbreviations in the caption.
- A legend (key to symbols), if required, needs to be given in an area in an unused corner of the figure to clarify meanings of line styles, symbols, or such other details given in the figure.
- A legend may also be an explanation consisting of one or more sentences. In this case the figure caption ends with a period after which the legend starts:

  Fig. 5.2: Annual Production of Indian Steel Plants. This figure indicates the annual production of hot metal in India.

  In yet another practice, which is not recommend, the caption is omitted. The legend follows immediately after the figure number (followed by a colon and a space).
- The lines in a figure should never be thinner than 0.5 point and should be of uniform density. Sometimes a research student may reduce the size of a figure to fit it into a page; while doing so care should be taken to ensure that the lines in thereduced figure to appear in the thesis copy should be of at least 0.5 point.
- Figures of equal importance should be of same size.
- For computer-generated figures, the output must have a minimum resolution of 300 dots per inch (dpi).
- If a figure is taken from an already published work of someone else (even if the work is in public domain), its source must be cited. It should be mentioned below the figure caption. For such reproduction you have to take prior permission of the copyright owner and write "With permission from . . ." as a footnote to the figure.

If you have published a paper and like to reproduce a figure from that paper, you need to get the permission of the publisher unless such a permission is given in the signed copyright transfer from.

- Sometimes you may use the data published by someone else to develop a figure (for example, a graph). It is desirable that you credit the source by writing
  Data from . . . after the figure caption.
- Like tables, all figures need to be referenced in the text. The styles of referencing figures in the text are also similar to those of the tables:

  Figure 8.2 shows the variation of …

  The variation of . . . is shown in Fig. 8.2.
  The variation of . . . is plotted (Fig. 8.2).
- Merely referencing figures in the text is not enough. One needs to discuss, in the text, all the essential features depicted in the figure.
- Like tables, a figure should be placed after, and close to, the text where it is first referred; if it cannot be fitted on the page where it is first referred, it should be given on the top of the next page.
- Large-size figures need to be reduced in size to fit the width of the thesis,ensuring, as said earlier, that the line thickness in the reduced figure is not less than 0.5 point
- The preferred size of a figure is height: width :: 2:3.
- A sentence should not start with the abbreviation “Fig.”; instead it should start with the word “Figure”.

Graph

A graph is a special form of figure that shows the variation of dependent variables (Y- axis) with the change in the value of an independent variable (X-axis). The additional guidelines specific to a graph are as follows:

- Label both X and Y axes and write their units of measure.
- Do not crowd the interval marks on the axis scales.
- Line weights should be the heaviest for the graph, and the lightest for theboundary.

- All symbols and letters in the axis labels and the legend must be clear and readable (not less than 8 point).
- If one desires to compare values of two variables, then plot the two variables on the same graph, and plot them using the same scale.
- Give tick marks at equal intervals on each axis to indicate units of measurement.
- An axis label should be placed parallel to the axis unless the label is short (one or two words). Letters stacked vertically or words stacked vertically are bad.
- Legibility of graphs is very important. To have better clarity, choose the Y-axis scale such that the curves are separated by adequate space. Do not clutter a graph with too many curves. Usually, no more than four curves are shown in a graph.

Photograph

Guidelines specific to photographs are as follows:

- Photographs should be taken in proper lighting condition, suitable background and with subject clearly distinguishable.
- If a series of pictures are taken for comparison purpose, use the same height, the same angle, and the same distance from the subject.
- Indicate the scale, or at least provide a reference point, to indicate the relativesize.
- For micrographs, indicate the power to which the image was taken (either in the caption or on the figure itself).
- Original photographs, not photocopies, should be attached to each report.
- They should be high-quality, black-and-white glossy prints with good density,sharp focus, and details, and with good contrast between light and dark areas.
- A photograph should have rich contrast and sharp prints. A light or dark background can provide good contrast. It is good to use black-and-white prints to achieve better contrast.
- Highlight the subject and the details. Eliminate extraneous details.
- The recommended resolution of a photograph is 300 dpi (dots per inch), whereas that of a line art is 600 dpi.
- If color prints are chosen, then there must be color prints on all copies because photocopying a color print does not always give an accurate reproduction.
- While comparing two photographs, put them side-by-side.
- If a person's photograph is given, get the person's signed consent.
- Glue the photographs on to the pages rather than staple or pin it.
- Photographs should be placed on the main text of the thesis, not in the Appendix.

Appendix-D

GUIDELINES ON LITERATURE REVIEW, REFERENCING STYLE, AND QUOTATIONS

LITERATURE REVIEW

Purpose

A literature review is a critical, unbiased, and comprehensive evaluation of published information in *a chosen, specific area of study*. It describes, summarizes, evaluates, and articulates relationships among concepts underlying these publications, providing general understanding of findings, conclusions, and recommendations, bringing out their strengths and weaknesses, and identifying gaps, conflicting ideas (if any), and generalized concepts in the existing body of knowledge. It also helps in formulating *research questions* and shaping the *research objectives*.

Sources of Information

Sources of information on literature pertinent to an area of study can be many:
Books, journals, conference proceedings, theses, handbooks, encyclopedias, bibliographies, government publications, publications by industrial organizations, e-databases, worldwide web, personal communications and unpublished documents. References given in these sources provide additional sources of information.

Supervisors, DSC members, members in the audience during seminar presentations, friends, critics, and Central Library professionals can provide helpful tips on important sources of information.

Published material appearing to be related to the topic of the study may be very relevant, irrelevant, or peripheral to the topic. Irrelevant materials are to be discarded, and the peripheral ones are to be judged for their usefulness to the research topic.

A research student should document the full details of the source and update the list of references as and when he (or she) comes across a useful and relevant work.

Evaluation of Past Works

Evaluation of past works can be done in three phases.

Phase I:

Abstracts, introductions, and conclusions should be read to judge their relevance to the research topic. This phase also helps to access the background of the author, the publication date, the nature of presentation, the type of publication, and the intended audience.

Phase II

The researcher should critically analyze the contents with regard to the basic points, the research methods, the arguments, the results, and the inferences. This phase should lead the researcher to know the underlying assumptions and the contribution of the work and find its strengths, weaknesses, limitations, and flaws (if any).

Phase III

This phase requires the researcher to identify gaps in the existing body of literature in the area of study. This information helps to formulate the *research questions* and set the *objectives of the research work* to be pursued. Invalid assumptions, unsubstantiated hypotheses, unconvincing arguments, weak methods of analysis, and areas of future work stated in the works help in formulating the research questions that a researcher sets for him/her to answer. These research questions are thereafter articulated and specified as objectives of the thesis.

Writing a Literature Review

A literature review is a prerequisite for any research work. Often a research student is thus advised to write a literature review even in the first year of research.

A review of literature has to be structured. The worst form of literature review is to write a summary of each individual work in a separate paragraph. Thus written, a review becomes stereotyped; it can run up to a large number of pages without bringing out the essential features, much to the annoyance of the reader.

There are at least three ways a literature review can be organized: (1) Chronological, (2) Thematic, and (3) Methodological. In the *chronological* organization, the research student divides the years of publications into periods (e.g., decades) and highlight the specific contributions mode during each period with regard to issues addressed, research methods adopted, results obtained, and conclusions drawn.

If the researcher follows a *thematic* way of presentation, then for each theme, he (or she) presents, in a summary form, the following:

- the dominant viewpoints of the authors,
- the sequence of developments taken place in the thematic context,
- the debates and the controversies that these works have led to, and
- an independent critical analysis of the work.

A good critical analysis requires the researcher to give independent judgment on each of these aspects and bring out the scope for future work. It may often be possible to frame a set of hypotheses and raise research questions that need further inquiry to bridge the research gap. The reviewer might also highlight new issues that have remained unaddressed in the past but have emerged significant in the present context.

Sometimes, however, a review is organized around various *methodological* approaches adopted by authors in the past. Here the research student focuses on the relative strengths and weaknesses of each approach to address a specific issue. The review should give the researcher the opportunity to relax assumptions underlying the previous approaches and suggest a new approach, for example, one that is used in another discipline, to overcome a weakness of the most recent approach.

Whatever may be the organization of the review□□□chronological, thematic, or methodological, the reviewer may simultaneously refer to more than one work in one sentence if all address the same issue in a similar way.

A few tips for a good presentation of a literature review are the following:

- Starting a sentence (or a paragraph) by always citing the name of an author annoys the reader.
- While presenting others' works, the reviewer should present them in his (or her) own words, using quotes very sparingly.
- Quoting verbatim from a work requires the reviewer to give page number(s) (and the reference, following the approved referencing style. See below *Guidelines for Quotations* for details.
- Highlighting differences in approaches, results, interpretations, and inconsistencies provide a good background for building up the reviewer's argument to resolve the apparent conflicts and make the suggested alternative stand on stronger foundation.

REFERENCING STYLES

References are those sources that are actually referred to in the text whereas a bibliography lists those sources that were consulted and are relevant but are not necessarily referred to

in the text. A research student has to give a *list of references* (also called *references*) in the thesis but may not give a bibliography,

Many universities follow a single referencing style. It is The *Author-Date (Harvard) style of referencing* for use by the research students is encouraged. However, an academic unit (Department/Center/School) may standardize its own referencing style and ensure that all its research students follow this standardized style.

Whatever the referencing style may be, the following guidelines always apply:

- The works cited in the body of the thesis must be detailed in the list of references. Conversely, all the works appearing in the list of references must be referred to in the body of the thesis.
- The details of each source given in the list of references must be *complete*. It means it should give the following:

  For a Book

  Name(s) of the author(s), year of publication, title of the book, place of publication, name of publisher, edition number.

  For a Paper

  Name(s) of the author(s), year of publication, title of the paper, title of the journal, volume, number, and page numbers.

  For a Paper in an Edited Book

  Names of the authors, year of publication, title of the paper, title of the book, editor's/editors' name(s), place of publication, name of publisher, edition number, and page numbers.

  For a Paper in a Conference Proceedings

  Names of the authors, year of publication, title of the paper, title of the conference proceedings, venue of the conference, dates of conference, editor's/editors' name(s), place of publication, name of publisher, edition number, and page numbers.

For a Material on the Web

Name of the author or organization (if any), title of the material (if any), website address, and date accessed. Normally these details are included within parentheses in the text or as a footnote rather than in the list of references. It may be noted that *because of the volatile nature of information on electronic materials, many do not consider such web-based information as authentic and do not support inclusion of these materials as references*.

While referencing online sources, the author's (or the organization's) name and the title of the document may or may not be available. If they are available, then they should be given in the list of references along with the URL and the date on which it was accessed. However, if these details are not available, then only the URL and the date on which it was accessed should be included.

- The style and the order in which various items appear in the list of references must be followed consistently.
- Titles of the papers must appear in the list of references. *Although a number of journals (using different referencing styles) allow exclusion of names of the papers in the list of references, we do not favor such a practice in this Institute*.
- A few academic units of the Institute favor giving a list of references at the end of each chapter. The Institute does not forbid this practice, but it is desired that a list of references should be given only at the end of the thesis. Giving a list of references after each chapter requires the reader to search for the exact location of the references every time a reference is encountered. Such a practice also allows duplication of many references across more than one chapter.
- If there are multiple authors, then the list of references must contain names of all the authors (not just *et al*.).
- Do not include a work in the body of the thesis if it refers to a paper that was merely presented in a conference and did not appear in the Proceedings.
- The place of publication of books and conference proceedings must be given so that an interested person can actually access them.

The following four general referencing styles are popularly used:

1. Author-Date style
2. Author-Number style
3. Numerical style
4. Footnote style

Author-Date Style

Also known as *Harvard style*, this is the most popular style followed in scientific research. Variations of this style are the APA (American Psychological Association) style and the MLA (Modern Language Association) style.

In this style, a *reference in the text* (or *citation*) consists of one or more surnames (or the name of an organization) and a date [Examples: "Roy (1992)", "Sen and Smith (2003)",

"(Jones and Jones 2001)", "Ministry of Water Resources (2004)"]. And the *list of references* is sorted in alphabetical order by surname (including initials) and date.

The citation in the text can be also denoted by an invented identifier [Example: Moh 2006 instead of Mohapatra 2006]. Such a practice is not favored by many, however.

Author-Number Style

Like the Harvard style, the author-number style (also known as the *Vancouver style*) uses the author's surname (or the name of the organization) for a citation in the text. But the surname is followed by a number (written within parentheses) that represents the sequence of appearance of the citations in the text [e.g., Roy (1) and Carma (2, 3) have indicated . . .]. The numbers also correspond to their appearance in the list of references.

Numerical Style

Here the citation in the text is denoted by a number (Examples: [5], [5, 5,7], [5, 7], [5, 7], [5,7] [5], [7], [5],[7]). [Note here that different journals use different spacing standards after commas; a few journals need a space after every comma, whereas a few others do not need any such space. In fact, not having a comma is more common than having one.]

The list of references is sorted by the numerical order of the citations in the text or by the alphabetic ordering of the surnames in the list of references. IEEE Transactions follow the numerical ordering. When the alphabetic ordering is followed, then the number appearing for a reference in the list of references should be given in the citation in the text.

Footnote Style

The footnote style also uses the numerical style. Authors in the field of humanities sometimes use this style. Here the reference in the text is denoted by a superscripted number (e.g., [5]). The details of the reference are given as a footnote on the same page.

Sometimes, but very rarely, the details of all references are grouped and given at the end of the work. In this case they are called *notes* rather than footnotes.

Recommended Style at NIT Warangal

Unless standardized by your department and directed by the Head of the Department, a research student should follow the Harvard style because it offers more information to a reader. Also, during the preparation of the thesis, updating a list of references with details of a new source is relatively easy.

Details of the Harvard Style

References in the Text

A citation to a source appears in the text in two ways:

1. Author names form part of a sentence.
2. Author names do not form part of a sentence.

Author names as Part of a Sentence

Here the author names are followed by the full year of publication within parentheses.

Examples

- Sen (2002) argued . . .
- The view held by Sen and Pandit (2003) . . .
- Sen (2002a, 2002b, 2003) has shown … (Notice the use of "a" and "b" when the year of publication of the sources is the same, and notice also that the years are arranged in increasing order.)
- The work done by Gupta *et al.* (2005) . . . (In case of three or more umber of authors, use the first author's surname followed by *et al.*)
- The use of integer programming approach to the knapsack problem (Emerson, 2007; Gupta, 2005; Sen, 2004) . . .
  (Notice the following: 1. A comma separates the year of publication from the author's surname. 2. A semicolon separates two consecutive citations. 3. The Authors' surnames are arranged alphabetically.)

Do not use apostrophe. For example, instead of writing "Roy's (2003) contribution . . .", write "The contribution of Roy (2003) . . .".

Author names Not a Part of a Sentence.

Enclose the author names and the year within parentheses and place them at an appropriate place in the sentence. Notice, in each of the following examples, that if the parenthesized name and year are deleted, then the remaining sentence is grammatically correct and makes sense.

Examples:

- The argument put forward by several authors (e.g., Jones and Sen, 2006; Roy and Gupta, 2005) is …
- The mineral policy of India (Government of India Publication, 2006) …

Thus the following examples are not correct:

Examples:

- The work reported in (Jones, 2005) …
- The paper by (Jones, 2005) …

Oftentimes one may like to not only specify the reference but also the page numbers in the reference. Note that it is obligatory to put page number(s) when you quote materials from a source. *See below Guidelines on Quotations*.

Examples:

- The derivation by Whitehouse (2006, pp. 15–17) … (page numbering is optional).
- According to Pearson, Artificial Intelligence is "a …" (Pearson, 1985; p. 85).

Note: For single page, use p. (page); for multiple pages use pp. (pages), and give the first page number and the last page number (separated by an en dash, but not a hyphen) of the relevant material.

List of References

As indicated earlier, the list of references is sorted in alphabetical order by surname (including initials) and date. The items to appear in the details for each reference are already indicated earlier. There is no standard sequence of their appearance, however. A research student can follow any sequence, but he (or she) must use it consistently. Below we suggest the sequence to be followed for different forms of sources.

Examples:

Book

Forrester, J. W. (1961), Industrial Dynamics, Cambridge, Massachusetts: MIT Press, First Edition.

Paper

Forrester, J. W. (1958), Industrial Dynamics: A Managerial Breakthrough, Sloan Management Review, Vol. 30, No. 3, pp. 55□75.

Forrester, J. W. (1968a), Industrial Dynamics: After the First Decade, Management Science, Vol. 30, No. 5, pp. 45□65.

Forrester, J. W. (1968b), Industrial Dynamics: A Response to Ansoff and Slevin, Management Science, Vol. 30, No. 7, pp. 35□55.

Paper in an Edited Book

Forrester, J. W. (1970), Churches in the Transition between Growth and Equilibrium, in Towards Global Equilibrium: Collected Papers, by Meadows, D. H. and Meadows, D. L. (Eds.), Cambridge, Massachusetts: Productivity Press, Second Edition, pp. 45−65.

Quoting a Work

Anyone (an author of another work) can quote a portion of a published work or reproduce small graphic or pictorial material (*The Fair Use Principle*) for the purpose of (a) reviewing the work, (b) criticizing the work, or (c) getting a support for his (or her) own work. In such a case the author must (a) credit the original author's work, (b) quote accurately, and (c) not quote the work out of context, by interpreting it in a way different from the original intention of the work.

An entire work of another author cannot be quoted.

Quotations or graphic reproductions should not be so long that they overshadow or devalue the text by the person quoting the work.

QUOTATIONS

While writing the thesis, there may be a necessity to directly quote from a source. In such a case the author must duly acknowledge the source by referring to it in the text and giving its details in the list of references at the end of the thesis or in a footnote on the same page.

If the author quotes a number of passages from a copyrighted source, then written permission from the owner of the copyright is necessary.

Well-known proverbs, literary expressions, and mythological and Vedic verses can be written without quotation marks and without citing their sources.

Quoted text must match exactly with the original source with regard to words, spelling, capitalization, and punctuation (with the exception of quotation marks, commas, and periods, etc.):

- When quoted material is given in the running text, they are enclosed within double quotation marks. Any double quotation marks appearing in the quoted text are changed to single quotation marks:

  According to Ramaswamy (2001), "God is good to all."
  According to Ramaswamy (2001), "God is 'good to all.'"

  (Note: The phrase *good to all* was written within double quotation marks in the original text by Ramaswamy. Thus the second sentence is correct, whereas the first one is not.)

- A block quotation (such as a complete paragraph) is usually set off from the main text with an indent from the left and from the right and is not enclosed within quotation marks. Further, it is to be printed in single-line spacing and in smaller font.

  User interfaces can be tricky things to design, because different people have different styles of perceiving, understanding, and working. (Pfleeger, 2001; p. 214).

  (Note: The page(s) where the quoted text appears in the original source must be cited.)

- If a part of a sentence is intentionally omitted in a quotation, then three ellipsis points are used. Ellipsis points indicate omitted words or sentences from a quoted passage. They are three dots printed like periods and are separated by a space from each other, from any punctuation mark preceding them, and from the words on either side.

  If parts of a sentence are intentionally omitted in a quotation, then three ellipsis points are used that are separated . . . from the words on either side.

- If the portion omitted is the last part of a sentence with the retained part making a sentence, then the final period is put after the quotation and is followed by a space and three ellipsis points.

> If parts of a sentence are intentionally omitted in a quotation, then three ellipsis points are used. . . .

- Sometimes one may like to change the capitalization in the quoted material to maintain the syntactic relation with the quoting sentence. In such a case the changed letter should be put within brackets:

> A system is a "[c]ircle without any boundary".

Note: the word "circle" was written as "Circle" in the source text.

- Often a quoted text originally contained a word (or an expression) that may be misspelled (or wrongly used). When one quotes such a text, he (or she) should write, after the misspelled word (or expression), the word *sic* in italic and keep it within brackets:

> . . . color [*sic*] is . . .

- If one wishes to highlight certain words (or a portion) of the quoted text, then he (or she) may italicize them, but the words "Italics mine" or "Italics added" must appear within parentheses or brackets and must immediately follow the highlighted words or portion.

> User interfaces can be *tricky* (italics added) things to design, because different people have different styles of perceiving, understanding, and working. (Pfleeger, 2001; p. 214).

- If the quoted text originally contains an italicized expression, then one should write *Italics in original* to indicate the same.

> User interfaces can be *tricky* (italics in original) things to design, because different people have different styles of perceiving, understanding, and working. (Pfleeger, 2001; p. 214).