MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY
(*(An Institute of National Importance)*
BHOPAL (M.P.) – 462003

ADMISSION NOTICE

No/MANIT/Acad./2024/2486/1 **Date: 01.11.2024**

Applications are invited for the admission in the following programme for 2024-25 sessions:-

Ph.D. program, for Four (5) categories Full Time Research Students (104 number of seats), Part Time Research Students (77 number of seats), Sponsored Full Time (36 number of seats), JRF/Project Associates (In all Department/ Centers of MANIT, Bhopal) and Internal faculty members working in MANIT, Bhopal in regular capacity.

For details visit Institute website www.manit.ac.in and for application form visit

http://erp.manit.ac.in/ext/adm/login

The last date for receiving duly completed application form is **25th November 2024.**

DIRECTOR

To be published in the following papers

1. Dainik Bhaskar (All Edition)
2. Times of India (All Edition)

मौलाना आजाद राष्ट्रीय प्रोद्योगिकी संस्थान
भोपाल, मध्य प्रदेश

(भारत सरकार के गिक्षा मंत्रालय के अधीन राष्ट्रीय महत्व का संस्थान(

INFORMATION

BROCHURE

(2024 – 2025)

ADMISSION

Ph.D. Programme

(FULL TIME & PART TIME)

WINTER SESSION - 2025

TABLE OF CONTENTS

Note:

1. Candidates are advised to visit the institute website regularly for updates (if any). No individual communication via postal or e-mail shall be made regarding selection procedure by the institute.
2. Applicants are advised to go through the institute's Ph.D. Ordinance and amendments as available on the institute website http://www.manit.ac.in for norms, rules andregulations.
3. Institute reserves the right to refuse admission to any candidate, or cancel the whole admission process, without assigning any reason.
4. In case of any ambiguity, typographical error or mistake, the decision of Chairman, Senate shall be final.
5. All disputes related to admission shall be subject to Bhopal Jurisdiction only.

1. Introduction

Maulana Azad National Institute of Technology (MANIT), Bhopal was established as Maulana Azad College of Technology (MACT) in 1960. MANIT is successfully meeting the objective of producing skilled Technocrats of the highest quality who are able to take up the challenges of the industries and Research organizations of the country. MANIT offers various undergraduate and post graduate courses and research programs. This section covers all the information related to academic rules and connectivity to MANIT Bhopal .Under the peaceful and friendly environment, MANIT producing technocrats who are resources to Nation and the world. Our bright students with excellent technical skills have always been contributed to the successes of various sections towards the technical group.

Institute is successfully producing highest quality skilled manpower to cope up with challenges of modern technological advances with more than 260 faculties and 6000 students. The Institute offers 09 UG and 35 PG courses and also Ph. D. research programmes in engineering, Sciences, humanities and management.

Location

MANIT, Bhopal is situated at Bhopal city which is the capital of Madhya Pradesh and is known as city of Lakes. It is well connected by air, rail and roads. The Institute is about 16 km from Raja Bhoj International Airport, 7 km from Bhopal railway junction, and 5 km from central bust station. Weather of Bhopal is normally pleasant and temperature varies from 12^{o}C to 40^{o}C.

Campus

The total area of campus is 650 acres and protected by boundary wall and ring road. The entire campus consists of administrative and academic building, workshop, Library and community center, Residential area accommodation for students and staff and other general amenities such as post office, Shopping complex, a School for children, dispensary, auditoriums and sports complex with vast expand of open area. The campus is divided into three sections namely Academic Sector, Hostel sector, and Residential section

2. About Doctoral Research

MANIT Vision

"MANIT looks forward to becoming a global centre for technical and professional knowledge"

MANIT Mission

"To produce technical professionals abreast with competence, logical mindset, moral and ethical values and inner strength synchronous with the futuristic requirement of global business so as to strengthen the national economy"

To achieve Institute mission, the following institutional goals have been laid for doctoral research:

- To develop fundamentals knowledge in selected area from courses.
- To develop creativity and innovation in the selected area,
- To develop ability and skills to carry out independent research and development to face the industrial as well as societal challenges.
- To develop moral and ethical values in scholar.

3. Details of Opportunities for Ph. D. students

1. Ph.D. students can enroll in jointly supervised Doctoral Degree Program with All India Institute of Medical Sciences (AIIMS), Bhopal. **(Refer Appendix-A)**

2. TEACHING ASSISTANTSHIP:

Candidates selected as full time research students shall be eligible for Teaching Assistantship as per Government of India / Institute norms. This shall be awarded to the full time research students on a semester-to-semester basis depending upon regular registration in each semester and satisfactory academic performance of the scholar as per Ph.D. Ordinance (Clause 10.2.2) and subsequent amendments. Selected candidates will be required to assist in teaching in the respective departments, equivalent to 8 hrs per week. However, no teaching assistantship shall be provided to Internal and Sponsored candidates.

Candidates admitted in Part Time/Executive Ph.D. Program will not be entitled to any teaching assistance/ fellowship from the Institute.

4. Important Dates:

S. No.	Tentative Schedule	Date
1.	Last Date of form submission	**25.11.2024**
2.	Date of written test and Interview (only for full time with Institute fellowship/JRF)	**17.12.2024**
3.	Date of Interview (for Part Time/Executive and other sponsored/MoU/Internal candidate etc.)	**19.12.2024**
4.	Result Declaration	**23.12.2024**
5.	Admission Date	**03.01.2025**
6.	Start of Course work	As per Institute Academic Calendar

Institute reserves the right to change the schedule as per the prevailing conditions. Please visit regularly the Institute website www.manit.ac.in for further instructions &tentative schedule.

5. Ph. D. admission categories and Eligibility

Following are the four categories under which a candidate can apply depending upon his/her eligibility:

A. Full Time Research Students (104 number of seats).

B. Sponsored Full Time (36 number of seats Norms for Sponsored full time is attached at **Annexure – A**) ***Admission under sponsored Full Time category is only for the candidates from Government organization, Public Sector & Research Institute, as per Ph.D. 2016 Ordinance Clause No. 10.1.1 amendment. (Employer certificate required as Annexure B.*** **The admission for employees / officers of central/ State Institutions / organizations having more than 10 years of experience and academic MOU with MANIT Bhopal shall be given direct admission to Ph.D. program (maximum two numbers per department)**

C. JRF/Project Associates (In all Department/Centers of MANIT, Bhopal) (as per ordinance 10.1.1(3)) (***for JRF please submit the sanction letter and in case of Project Associates certificate required from respective department as Annexure C)***
Under the JRF category the candidates with minimum 03 years fellowship awarded from any Government agency are also allowed and they shall undergo the normal selection process as per other candidates.

D. Internal faculty members working in MANIT Bhopal in regular capacity. (Certificate required as per Annexure D).

E. Part Time / Executive Ph.D. (77 number of seats). **: Students with Masters Degree in relevant discipline will be eligible for admission in corresponding Part Time / Executive Ph.D. fulfilling the following eligible criterion as at point c.**

The admission of internal candidates of MANIT Bhopal in the program may be given with following norms:

(i) No change or relaxation of norms in admission process. The Candidate has to undergo normal selection process as external candidates.

(ii) They have to complete the course work as required for external candidates. However they will undergo course work as 8 credits per semester to balance as a student and educator.

(iii) There will not be any relaxation with respect to their academic and administrative duties.

(iv) Institute shall not bear any financial liability towards pursuing the Ph D Program.

(v) These candidates will be admitted as "Part Time (Internal)''.

DEPARTMENTS OFFERING Ph.D. PROGRAMMES:

S. No	Department/ Centre	S. No	Department/ Centre
1.	Architecture & Planning	10.	Energy Centre
2.	Biological Science & Engineering	11.	Electrical Engineering
3.	Centre for Artificial Intelligence	12.	Electronics & Communications Engineering
4.	Centre for Excellence in Product Design & Smart Manufacturing	13.	Humanities and Social Sciences
5.	Centre for Excellence in Water Management	14.	Management Studies
6.	Chemical Engineering	15.	Materials & Metallurgical Engineering
7.	Chemistry	16.	Mathematics, Bioinformatics & Computer Applications (MBC)
8.	Civil Engineering	17.	Mechanical Engineering
9.	Computer Science & Engineering	18.	Physics

Eligibility Criteria

a) For admission categories A, C, and D

S. No.	Stream	Essential Qualification In Relevant Area	
1	Engineering	Bachelors & Master degree in Relevant Engineering with Minimum of **60% marks / CGPA 6.5**, with GATE ***qualified.***	
		Bachelors degree in Relevant Engineering with minimum of **70% Marks / CGPA 7.5 or above,** with **GATE *qualified.***	
		Bachelors degree in Relevant Engineering with minimum of **80% Marks/CGPA 8.5 or above from Institute of National Importance (IIT/IIIT/NIT),** without **GATE *qualified.***	
2	Sciences	Bachelors & Master degree in Relevant Sciences/ Engineering with minimum of **60% marks/CGPA 6.5** with **NET/ GATE** Qualified.	
3	Architecture and Planning	a	Master degree in Architecture / Planning with minimum of **60% marks / CGPA 6.5** with **GATE** qualified.
		b	Bachelors degree in Architecture/Planning with minimum of **70% marks / CGPA 7.5 or above** with **GATE *qualified.***
		c	Bachelors degree in Architecture/Planning with Minimum of **80% marks/CGPA 8.5 or above from Institute of National Importance (IIT/SPA/NIT)** without **GATE *qualified.***
4	Humanities and Social Sciences	Bachelor's degree in any stream and Master degree in Humanities / Social Sciences with minimum of **60% marks / CGPA 6.5** with **NET qualified.**	
5	Management	Bachelors degree in any stream and Master degree in Management/Engineering with minimum of **60% marks / CGPA 6.5** with **NET/GATE qualified**	

***Reservations are as per prevailing GOI Norms. For reserved category students i.e. SC/ST/PwD a relaxation of 5% (0.5 in CGPA) is applicable**.

*b) For admission category B**

S. No.	Stream	Essential Qualification
1	Engineering	Bachelors & Master degree in relevant Engineering with minimum of **60% marks or CGPA 6.5.**
2	Sciences	Bachelors & Master degree in relevant Sciences / Engineering with minimum of **60% marks or CGPA 6.5**.
3	Architecture and Planning	Bachelors & Master degree in Architecture/Planning with minimum of **60% marks or CGPA 6.5**
4	Humanities and Social Sciences	Bachelors degree in any stream and Master degree in Humanities /Social Sciences with minimum of **60% marks / CGPA 6.5**
5	Management	Bachelors degree in any stream and Master degree in Management/Engineering with minimum of **60% marks / CGPA 6.5**

***Reservations are as per prevailing GOI Norms. For reserved category students i.e. SC/ST/PwD a relaxation of 5% (0.5 in CGPA) is applicable.**

c) For admission category E

1.	Engineering, Sciences, Architecture &Planning, Humanities and Social Sciences & Management	Master's degree in relevant discipline with minimum of **60% marks / CGPA 6.5** (on a 10-point Scale) or equivalent, in the qualifying degree.
		Minimum two years job experience for candidates from Industry
		Minimum one year of job experience for candidates belonging to academic Institutions/ research organization
		The requirement of job experience may be relaxed by the Institute for candidates having a minimum **CGPA of 7.5** (on a 10-point Scale) or equivalent, in the qualifying degree.
		Regular Government Employee
		A certificate with regard to the experience is required in the format as per Annexure F

***Reservations are as per prevailing GOI Norms. For reserved category students i.e. SC/ST/PwD a relaxation of 5% (0.5 in CGPA) is applicable.**

6. Seat Matrix

(a) Full Time Research Students

S. No	Department	UR	EWS	SC	ST	OBC	Total
1	**Architecture & Planning**	0	2	1	1	3	7
2	**Biological Science & Engineering**	0	1	0	0	0	1
3	**Centre for Artificial Intelligence**	2	1	1	0	2	6
4	**Centre for Excellence in Product Design & Smart Manufacturing**	2	1	1	0	2	6
5	**Centre for Excellence in Water Management**	1	1	0	0	2	4
6	**Chemical Engineering**	2	0	1	1	3	7
7	**Chemistry**	0	1	0	1	2	4
8	**Civil Engineering**	1	2	3	4	4	14
9	**Computer Science & Engineering**	1	1	2	0	2	6
10	**Energy Centre**	1	0	1	1	2	5
11	**Electrical Engineering**	1	2	1	1	4	9
12	**Electronics & Communications Engg.**	0	1	2	1	5	9
13	**Materials & Metallurgical Engineering**	2	0	0	1	2	5
14	**Mathematics, Bioinformatics & Computer Applications (MBC)**	1	1	1	1	2	6
15	**Mechanical Engineering**	2	0	2	2	2	8
16	**Physics**	2	1	1	1	2	7
17	**Humanities and Social Sciences**	0	0	0	0	0	0
18	**Management Studies**	0	0	0	0	0	0
Total		**18**	**15**	**17**	**15**	**39**	**104**

(b) **Sponsored Full Time:** There shall be two seats of Sponsored candidates in each department as mentioned at point no. 2 totaling to 36 seats. Norms for Sponsored full time is attached at Annexure – A.

(c) Part Time Research Scholar

S. No	Department	UR	EWS	SC	ST	OBC	Total
1	**Architecture & Planning**	0	2	2	1	5	10
2	**Biological Science & Engineering**	0	0	1	0	1	2
3	**Centre for Excellence in Product Design & Smart Manufacturing**	0	1	0	0	2	3
4	**Centre for Excellence in Water Management**	0	1	1	0	2	4
5	**Chemical Engineering**	0	0	0	1	2	3
6	**Chemistry**	0	0	1	1	1	3
7	**Civil Engineering**	0	2	3	0	4	9
8	**Computer Science & Engineering**	0	1	0	1	0	2
9	**Energy Centre**	0	0	1	1	2	4
10	**Electrical Engineering**	0	2	2	1	4	9
11	**Electronics & Communications Engineering**	0	1	2	1	0	4
12	**Humanities and Social Sciences**	0	1	1	1	2	5
13	**Management Studies**	0	1	0	0	0	1
14	**Materials & Metallurgical Engineering**	0	0	0	1	1	2
15	**Mathematics, Bioinformatics & Computer Applications (MBC)**	0	1	1	1	4	7
16	**Mechanical Engineering**	0	2	0	2	1	5
17	**Physics**	0	0	1	1	2	4
18	**Centre for Artificial Intelligence**	0	0	0	0	0	0
	Total	**0**	**15**	**16**	**13**	**33**	**77**

Note:

(i) The reservation of Persons with Disability (PwD) is 5% overall as per Government of India norms. Reservation of SC/ST/OBC/EWS is as per prevailing GoI norms.

(i i) Institute reserve the right to change the seat allocation as per the selection ofcandidates for admission

7. Regulations for Part time Research Scholar:

(i) **Program Duration:** Under normal circumstances, the minimum permissible Part-time / Executive Ph. D. program durations will exceed the corresponding Full-time Ph.D. Program durations by One Year. However, the maximum Ph.D. program completion duration will remain the same as the Full-time Ph.D. program completion duration i.e. 7 years.

(ii) Requirement for Course work and Residency:

a) A student enrolled in a Part-time / Executive Ph.D. program has to complete all requirements of the course work and earn as many credits as specified by the institute in the scheme of the corresponding Full-time Ph.D. program.

b) The candidate will have a liberty to opt for equivalent NPTEL Courses in lieu of regular courses floated by the institute subject to approval of competent authority.

c) A Part-time / Executive Ph.D. student will be expected to remain in regular touch with his Research Supervisor(s) through the entire duration of the program. He will be expected to spend at least two weeks in the institute in every semester and complete all stipulated program requirements including, but not limited to, the SRPC meetings, RDC meeting, Seminars, etc.

(iii) **Course Scheme:** A Part-time/ Executive Ph.D. Program will allow the student to complete his/ her coursework requirement mandatory in two years. The SRPC will have to be constituted immediately after the completion of coursework and the meeting of SRPC will happen once in every semester. The RDC meeting will have to be conducted within a year after completion of course work.

(iv) **Dissertation / Thesis / Research Supervisor & Allotment and Eligibility:** The norms and modalities for allotment of a Research Supervisor for a Part-time/ Executive Ph.D. Program – enrolled candidate will be as per the prevalent standard Institute norms prevalent at that point of time. Any change in the allotted Research Supervisor will also be subject to standard institute norms.

(v) **Registration / Desk Registration** The registration procedure for all Part-time/ Executive Ph.D. Programs will be as per academic calendar.

(vi) **Other norms** (Thesis Submission, RDC Constitution, SRPC meetings, Paper publication, etc.). To be at par with the corresponding Full-time Academic Program (Ph.D.) Norms stipulated by the institute.

(vii) **Class Timings:** All students enrolled in Part-time / Executive Ph.D. programs will attend their classes with the corresponding full-time students in the same time duration. The classes will be conducted early morning during normal institute hours, or as decided by the concerned department.

8. Application Procedure:

Applications are invited for Full Time / Part Time Ph.D. Programme in the Departments as listed in point no. 5:

a) The application form can be filled from http://erp.manit.ac.in/ext/adm/login

b) Hard copy of completed application form (downloaded filled on ERP) along with self attested copies of essential documents and **non-refundable processing fee of Rs. 1500/- (for UR, OBC & EWS) and Rs. 1000/- (for SC/ST/PwD candidates) should be submitted to Assistant Registrar (Academic), MANIT Bhopal – 462003 up to 25th November 2024** The payment of processing fee is to be done only through Gate way available in the online application form. **The envelope must contain the following header "Application form for Ph.D. Admission in ……Department".**

c) Applicant must submit separate processing fees, if he/she wishes to apply in different departments. Applications received after due date will not be entertained.

d) No individual communication via postal or e-mail shall be made regarding the written test and/or interview of the institute. The schedule of the selection process will be displayed on the institute website only, after initial scrutiny of the application forms. Candidates are advised to visit the institute website regularly for further updates.

e) List of Essential Documents:

(i) If applicants have applied for multiple departments, the priority list of the choice of department duly signed must be submitted on a plane paper.

(ii) 10th Class Marksheet

(iii) 12th Class Marksheet

(iv) Graduation Marksheets (All semesters)

(v) Graduation Degree Certificate

(vi) Post Graduation Marksheets (All semesters)

(vii) Post Graduation Degree Certificate / Completion Certificate

(viii) GATE score card / NET qualified certificate & score card for required category

(ix) EWS/OBC/SC/ST/PWD Certificate, If applicable

(x) Experience Certificate (if applicable)

(xi) NOC from employer if employed

(xii) Publication details, if applicable

(xiii) OBC-NCL certificate (issued by competent authority on or after 1st April 2024)

(xiv) EWS Certificate (issued by competent authority on or after 1st April, 2024)

(xv) Copy of Fee Payment Receipt.

(xvi) Any other relevant documents

9. Fee structure

The fee structure for the session 2024-25 is attached at Annexure – E & available on Institute website. There will be no exemption of tuition fee to any category of Ph.D. students.
Hostel facility is not available for Ph.D. Students.

10. Selection Procedure

For Full time Ph. D. Program (research scholar with Institute fellowship /JRF /Project Associates)

The selection will be based on the candidate's academic research profile and following criteria.

Weightage of written test	70%
Weightage of Interview (if found eligible for research)	30%

Written Test: For each department, admission test of total one hour shall be conducted as per following structure**:**

- Concerned Discipline (Max. Marks: 100, Duration: 01 hour, Questions: 50). In this section, the syllabus of GATE/NET/CAT for the respective discipline shall be followed- as per the attached syllabus.

NOTE: Qualifying in GATE / NET is not mandatory, but the Institute, on its sole discretion, may relax the requirement of written test and/or interview in such cases. The same criterion will be applicable to candidates with a valid GATE / NET score.

- **TA/DA will not be paid for attending the written test &/or Interview.**

For Executive / Part time Ph.D. program (Sponsored full time/ Part time (sponsored from Company / Govt. organization / PSU) / Internal faculty member)

There is no written test for selection of part time Ph. D. program. Only Departmental Interview and candidate's academic research profile will based for selection.

11. Address for Communication

The hardcopy of the application along with the self attested documents and fee details should be sent by speed post to :

Assistant Registrar (Academic)
Maulana Azad National Institute of Technology (MANIT),
Near Link Road No. 03,
Bhopal (MP) – 462 003
Contact No. - 0755-4051055, 0755-4051056

Please visit regularly the Institute website *www.manit.ac.in* for further instructions & schedule.

DIRECTOR

Annexure – A

Ph.D. Ordinance Clause no. 10.1.1 Amendment For Sponsored Full Time Ph.D. student	**The admission for employees / officers of central/ State Institutions / organizations having more than 10 years of experience and academic MOU with MANIT Bhopal shall be given direct admission to Ph.D. program (maximum two number per department)**

Annexure B

Certificate from the employer for sponsored candidates to be issued on Employer's letter head

1. Name of the Employee : _____

2. Type of Organization: ☐ Central Government ☐
   ☐ State Government
   ☐ National Level Research Organization Public Sector Enterprise

3. Address of Administrative : _____
   Officer/HR Manager _____
   Phone :_____ Fax:_____
   Email :_____ Mob._____

4. Designation of the Employee : _____
   Seeking admission in MANIT

5. Employment Details :
   a) First joined on (date) : _____
   b) Holding the present : _____
      Position since (date)
   c) Nature of Job : _____

(R & D, Design, Production, Marketing, Administrative, Teaching)

This is to certify that, Mr/Ms._____ employed as _____ in this organization in regular capacity, is sponsored for admission to Full Time Ph.D Programme at MANIT, Bhopal. He / She has been employed in this organization for the past_____years in a regular cadre. If selected the organization has no objection to his/her undergoing Ph.D Programme under Sponsored category at MANIT, Bhopal. He/ She, if selected, shall be allowed to attend the classes in day time and to stay in the campus/ Bhopal during his/ her Ph.D program course work.

_____ _____

Signature of Applicant Seal & Signature of Competent Authority

Annexure C

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY

BHOPAL– 462003 (M.P.) INDIA
(An Institute of National Importance)

No objection Certificate for Admission to Ph.D. programme (Project)

Reference No. Date :_____

Sub. : No Objection Certificate

Dear Sir,

We have no objection if Mr./Mrs./Ms./ _____
Designation_____,a project staff, under the project (title of the project), sanction letter No._____, in the Department of_____ is admitted to the Ph.D. programme in the Department of_____ of Maulana Azad National Institute of Technology Bhopal. It is certified that the said project shall continue for at least three more year.

If selected, we shall allow him/her to attend classes/research work under the said project at Maulana Azad National Institute of Technology Bhopal during the Ph.D. programme without affecting normal project work assigned to him/her.

Signature of Project Investigator Signature of Dean (R&C)

Name _____

Annexure D

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY

BHOPAL– 462003 (M.P.) INDIA

(An Institute of National Importance)

No objection Certificate for Admission in to Ph.D. programme (Institute Employer)

Reference No.: Date :_____

It is certified that we have no objection if Mr./Mrs./Ms. _____ Designation_____a (regular) employee of this Institute, working in the Department of_____, is admitted in to the Ph.D. Programme in the Department of _____ at this Institute as a Part Time (Internal).

If selected, he/she shall be allowed to attend classes/research work, without affecting normal duties assigned to him/her.

Signature of Head
(Department)

Signature of Director

Annexure E-1

Fee Structure for Ph.D. Students

(Full Time/JRF/Internal/Sponsored) Session 2024-25

	Maulana Azad National Institute of Technology, Bhopal	
	Fee Structure for Ph.D. Students for the session 2024-25	
Sl. No	**Fee Details**	**1st Semester Fee (DAY SCHOLAR)**
1	Tuition Fee	**10000.00**
	One Time Fee	
1.	Caution Money (Refundable)	5000.00
2.	Academic Fee (Including Degree, Migration, Character & I Card)	2000.00
3.	Alumni Fee	1000.00
4.	Convocation Fee	2000.00
	Total One Time fee	**10000.00**
	Semesters Fee	
5.	Poor Students Fund	600.00
6.	Students Medical Fund	400.00
7.	Bus Fee	400.00
8.	Institute Development Fund	2500.00
9.	Students Activity Fee	1000.00
10.	Library Fee	1000.00
11.	Registration & Examination Fee	1500.00
12.	Central Computing facility & Internet fee	1500.00
	Total of other fee	**8900.00**
	Grand Total (Tuition fee + semester fee + other fee)	**28900.00**
	Medical and other Fee	**600.00**
	Total Rs.	**29500.00**
	Hostel Fee will be paid extra if required	

Annexure E -2

Fee Structure for Ph.D. Students (Part Time/ Executive) Session 2024-25

	Maulana Azad National Institute of Technology, Bhopal
	Fee Structure for Ph.D. Students for the session 2024-25

Sl. No	Fee Details	1st Semester Fee (DAY SCHOLAR)
1	Tuition Fee	**10000.00**
	One Time Fee	
1.	Caution Money (Refundable)	5000.00
2.	Academic Fee (Including Degree, Migration, Character & I Card)	2000.00
3.	Alumni Fee	1000.00
4.	Convocation Fee	2000.00
	Total One Time fee	**10000.00**
	Semesters Fee	
5.	Poor Students Fund	600.00
6.	Students Medical Fund	400.00
7.	Institute Development Fund	2500.00
8.	Students Activity Fee	1000.00
9.	Library Fee	1000.00
10.	Registration & Examination Fee	1500.00
11.	Central Computing facility & Internet fee	1500.00
	Total of other fee	**8500.00**
	Grand Total (Tuition fee + semester fee + other fee)	**28500.00**
	Medical and other Fee	**600.00**
	Total Rs.	**29100.00**
	Hostel Fee will be paid extra if required	

Annexure F

Certificate from the employer for Part Time/Executive Ph. D. candidates to be issued on Employer's letter head

1. Name of the Employee : _____

2. Type of Organization: ☐ Industry
   ☐ Research Organization
   ☐ Academic Institutions

3. Address of Administrative : _____
   Officer/HR Manager _____
   Phone :_____Fax:_____
   Email :_____Mob._____

4. Designation of the Employee:_____
   Seeking admission in MANIT

5. Employment Details :
   a) Total Job Experience on the last date of application submission: .....Years ……Month
   b) First joined on : ……Date……..Month .....Year
   c) Holding the present position since (date) : ……Date……..Month ..... Year
   c) Nature of Job : _____
   (R & D, Design, Production, Marketing, Administrative, Teaching)

This is to certify that, Mr/Ms._____employed as_____in this organization in regular capacity, is permitted for admission to Part Time/Executive Ph.D. Programme at MANIT, Bhopal. He / She has been employed in this organization for the past_____years in a regular cadre. If selected the organization has no objection to his/her undergoing Ph.D. Programme under Part Time/Executive category at MANIT, Bhopal. He/ She, if selected, shall be allowed to attend the classes during day time during his/her Ph.D. program course work.

_____

_____

Signature of Applicant

Seal & Signature of Competent Authority

Name, Designation

For further information,

Please contact:

Admission Section

Maulana Azad National Institute of Technology Bhopal,

Link Road No.- 03

Bhopal – 462003 (Madhya Pradesh)

Contact No. - 0755-4051055, 0755-4051056

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY, *BHOPAL*

(An Institute of National Importance under Ministry of Education, Govt. of India)

SYLLABUS FOR FULL TIME PH.D. PRORAMME ENTRANCE EXAM FOR SESSION 2024-2025 (WINTER 2025)

INDEX

Department of Architecture and Planning

Part A: Common

Section 1: Architecture, Planning and Design

Architectural Graphics; Visual composition in 2D and 3D; Computer application in Architecture and Planning; Anthropometrics; Organization of space; Circulation- horizontal and vertical; Space Standards; Universal design; Building byelaws; Codes and standards;

Section 2: Construction and Management

Project management techniques e.g. PERT, CPM etc.; Estimation and Specification; Professional practice and ethics; Form and Structure; Principles and design of disaster resistant structures; Temporary structures for rehabilitation;

Section 3: Environmental Planning and Design

Natural and man-made ecosystem; Ecological principles; Environmental considerations in Planning and design; Environmental pollution- types, causes, controls and abatement strategies; Sustainable development, goals and strategies; Climate change and built environment; Climate responsive design;

Section 4: Urban Design, landscape and Conservation

Historical and modern examples of urban design; Elements of urban built environment – urban form, spaces, structure, pattern, fabric, texture, grain etc.; Concepts and theories of urban design; Principles, tools and techniques of urban design; Public spaces, character, spatial qualities and Sense of Place; Urban design interventions for sustainable development and transportation; Development controls – FAR, densities and building byelaws.; Urban renewal and conservation; heritage conservation; historical public spaces and gardens; Landscape design; Site planning;

Section 5: Planning process

Salient concepts, theories and principles of urban planning; concepts of cities - Eco-City, Smart City; Concepts and theories by trendsetting planners and designers; Ekistics; Urban sociology; Social, Economic and environmental cost benefit analysis; Methods of non-spatial and spatial data analysis; Development guidelines such as URDPFI;

Section 6: Housing

Housing typologies; Concepts, principles and examples of neighborhood; Residential densities; Affordable Housing; Real estate valuation;

Section 7: Services and Infrastructure

Fire fighting Systems; Building Safety and Security systems; Building Management Systems; Water treatment; Water supply and distribution system; Water harvesting systems; Principles, Planning and Design of storm water drainage system; Sewage disposal methods; Methods ofsolid waste management - collection, transportation and disposal; Recycling and Reuse of solid waste; Land-use – transportation - urban form inter-relationships; Design of roads, intersections, grade separators and parking areas; Hierarchy of roads and level of service; Para-transits and other modes of transportation, Pedestrian and slow moving traffic planning;

Part B1: Architecture

Section B1.1: History and Contemporary Architecture

Principles of Art and Architecture; World History of Architecture: Egyptian, Greco-Roman classical period, Byzantine, Gothic, Renaissance, Baroque-Rococo, etc.; Recent trends in Contemporary Architecture: Art nouveau, Art Deco, Eclecticism, International styles, Post Modernism, Deconstruction in architecture, etc.; Influence of Modern art and Design in Architecture; Indian vernacular and traditional Architecture, Oriental Architecture; Works of renowned national and international architects;

Section B1.2: Building Construction and Structural systems

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Construction planning and equipment; Building material characteristics and applications; Principles of strength of materials; Alternative building materials; Foundations; Design of structural elements with different materials; Elastic and Limit State design; Structural systems; Principles of Pre-stressing; High Rise and Long Span structures, gravity and lateral load resisting systems;

Section B1.3: Building Services and Sustainability

Solar architecture; Thermal, visual and acoustic comfort in built environments; Natural and Mechanical ventilation in buildings; Air-Conditioning systems; Sustainable building strategies; Building Performance Simulation and Evaluation; Intelligent Buildings; Water supply; Sewerage and drainage systems; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system; Principles of electrification of buildings; Elevators and Escalators - standards and uses;

Part B2: Planning

Section B2.1: Regional and Settlement Planning

Regional delineation; settlement hierarchy; Types and hierarchy of plans; Various schemes and programs of central government; Transit Oriented Development (TOD), SEZ, SRZ etc.; Public Perception and user behaviour; National Housing Policies, Programs and Schemes.; Slums, Squatters and informal housing; Standards for housing and community facilities; Housing for special areas and needs;

Section B2.2: Planning Techniques and Management

Application of G.I.S and Remote Sensing techniques in urban and regional planning; Tools and techniques of Surveys – Physical, Topographical, Land use and Socio-economic Surveys; Urban Economics, Law of demand and supply of land and its use in planning; Graphic presentation of spatial data; Local self-governance, Panchayatiraj institutions; Planning Legislation and implementation – Land Acquisition Act, PPP etc.; Decision support system and Land Information System; Urban geography and econometrics; Management of Infrastructure Projects; Demography and equity in planning;

Section B2.3: Infrastructure Planning

Process and Principles of Transportation Planning and Traffic Engineering; Road capacity and Travel demand forecasting; Traffic survey methods, Traffic flow Analysis; Traffic analyses and design considerations; Traffic and transport management and control in urban areas; Mass transportation planning; Intelligent Transportation Systems; Urban and Rural Infrastructure System Network.

Department of Biological Science & Engg.

I. Molecular Biology and Molecular Tools in Biotechnology

1. Basic Molecular Biology: DNA structure and replication, RNA structure and transcription, Protein synthesis: Translation, Genetic code and regulation of gene expression, post-translational modifications.
2. Molecular Tools in Biotechnology: PCR (Polymerase Chain Reaction), DNA sequencing techniques, Molecular cloning techniques, Gene expression analysis
3. Genetic Engineering: Genetic modification of organisms, CRISPR-Cas9 technology, Synthetic biology
4. Molecular Biology Applications: Molecular diagnostics, Gene therapy, Drug development and design

II. Cell Biology

1. Cell Structure and Function: Cell organelles, Cellular membranes and transport, Cytoskeleton
2. Cell Cycle and Cell Division: Mitosis and meiosis, Cell cycle regulation
3. Cell Signaling: Signal transduction pathways, Cell communication
4. Stem Cell Biology: Types of stem cells, Applications in biotechnology

III. Biochemistry

1. Biomolecules: Proteins, nucleic acids, lipids, carbohydrates, Enzyme structure and function
2. Metabolism: Glycolysis and Krebs cycle, Metabolic pathways, Regulation of metabolism
3. Biochemical Techniques: Chromatography, Spectroscopy, Electrophoresis

IV. Immunology

1. Innate and Adaptive Immunity: Antigens and antibodies, Immune cells and organs
2. Immunological Techniques: ELISA, Western blotting, Flow cytometry
3. Vaccines and Therapeutics: Vaccine development, Immunotherapy

VII. Industrial Biotechnology and Bioprocess Engineering

1. Fermentation Technology: Microbial fermentation, Bioreactors
2. Downstream Processing: Separation techniques, Purification of bioproducts
3. Bioprocess Optimization: Process monitoring and control, Scale-up strategies

VIII. Plant and Animal Biotechnology

1. Genetic Engineering in Plants: Transgenic plants, Crop improvement
2. Plant Tissue Culture: Micropropagation, Somatic embryogenesis
3. Transgenic Animals: Production and applications
4. Cloning Techniques: Somatic cell nuclear transfer, Reproductive cloning

X. Microbial Biotechnology

1. Basic microbiology: Microbial structure and function, Microbial growth and control
2. Microbial Genetics: Plasmids and horizontal gene transfer, Microbial genomics
3. Microbial Fermentation: Industrial applications, Strain improvement
4. Biofuels, bioplastics, industrial enzymes, antibiotics

XI. Recombinant DNA Technology

1. DNA Recombination: Restriction enzymes, DNA ligation, DNA modification enzymes
2. Gene Cloning: Vector systems, Transformation techniques, Gene isolation and cloning, strategies for production of recombinant proteins
3. cDNA and genomic DNA library, Transposons and gene targeting

XII. Analytical Tools in Biotechnology

1. Microscopy Techniques: Light Microscopy, Electron microscopy, fluorescent microscopy, confocal microscopy
2. Spectrometry: UV-Vis spectroscopy, Spectroscopy, Infrared (IR) Spectroscopy, Fluorescence Spectroscopy, Mass Spectroscopy, NMR Spectroscopy
3. Electrophoresis techniques: Gel Electrophoresis, Capillary Electrophoresis, Protein Electrophoresis, Nucleic acid Electrophoresis
4. Microarray technology: DNA Microarray, Protein Microarray
5. Immunoassays: ELISA, Radioimmunoassay, Immunohistochemistry, Immunoblotting, Flow Cytometry
6. Sequencing Technologies: Sanger sequencing, Next Generation sequencing,

XIII. Computational Biology and Bioinformatics

1. Computational Tools and Algorithms: Sequence analysis, Phylogenetic analysis, Structural Bioinformatics, Systems Biology
2. Biological Databases: Genomic databases, Protein databases, Metabolic pathway databases, Literature databases and tools
3. Gene predictions, Functional annotations, Secondary and 3D structure prediction, Metagenomics

- **Casting:** Types of casting processes and applications; Sand casting: patterns – types, materials and allowances; moulds and cores–materials, making, and testing; design of gating system and riser; casting techniques of cast iron, steels, and non-ferrous metals and alloys; analysis of solidification and microstructure development; Other casting techniques: Pressure die casting, Centrifugal casting, Investment casting, Shell mould casting; Casting defects and their inspection by non-destructive testing.
- **Metal Forming:** Stress-strain relations in elastic and plastic deformation; von Mises and Tresca yield criteria, Concept of flow stress; Hot, warm and cold working; Bulk-forming processes – forging, rolling, extrusion and wire drawing; Sheet metal working processes – blanking, punching, bending, stretch forming, spinning and deep drawing; Ideal work and slab analysis; Defects in metalworking and their causes.
- **Joining of Materials:** Classification of joining processes; Principles of fusion welding processes using different heat sources (flame, arc, resistance, laser, electron beam), Heat transfer and associated losses; Arc welding processes – SMAW, GMAW, GTAW, plasma arc, submerged arc welding processes; Principles of solid-state welding processes – friction welding, friction stir welding, ultrasonic welding; Welding defects – causes and inspection; Principles of adhesive joining, brazing and soldering processes.
- **Powder Processing:** Production of metal/ceramic powders, compaction and sintering of metals and ceramic powders, Cold and hot isostatic pressing.
- **Polymers and Composites:** Polymer processing – injection, compression and blow moulding, extrusion, calendaring and thermoforming; Molding of composites.
- **Machining:** Orthogonal and oblique machining, Single point cutting tool and tool signature, Chip formation, cutting forces, Merchant's analysis, Specific cutting energy and power; Machining parameters and material removal rate; tool materials, tool wear and tool life; Thermal aspects of machining, cutting fluids, machinability; Economics of machining; Machining processes – turning, taper turning, thread cutting, drilling, boring, milling, gear cutting, thread production; Finishing processes – grinding, honing, lapping and superfinishing.
- **Machine Tools:** Lathe, milling, drilling and shaping machines – construction and kinematics; Jigs and fixtures –principles, applications, and design.

- **Advanced Manufacturing:** Principles and applications of USM, AJM, WJM, AWJM, EDM and Wire EDM, LBM, EBM, PAM, CHM, ECM; Effect of process parameters on material removal rate, surface roughness and power consumption; Additive manufacturing techniques.
- **Computer Integrated Manufacturing:** Basic concepts of CAD and CAM, Geometric modelling, CNC; Automation in Manufacturing; Industrial Robots – configurations, drives and controls; Cellular manufacturing and FMS – Group Technology, CAPP.
- **Metrology and Inspection:** Accuracy and precision; Types of errors; Limits, fits and tolerances; Gauge design, Interchangeability, Selective assembly; Linear, angular, and form measurements (straightness, flatness, roundness, runout and cylindricity) by mechanical and optical methods; Inspection of screw threads and gears; Surface roughness measurement by contact and non-contact methods.
- **Engineering mechanics** – equivalent force systems, free body concepts, equations of equilibrium; Trusses; Strength of materials – stress, strain and their relationship; Failure theories; Mohr's circle (stress); Deflection of beams, bending and shear stresses; Euler's theory of columns; Thick and thin cylinders; Torsion.
- Analysis of planar mechanisms, cams and followers; Governors and flywheels; Design of bolted, riveted and welded joints; Interference/shrink-fit joints; Friction and lubrication; Design of shafts, keys, couplings, spur gears, belt drives, brakes and clutches; Pressure vessels.
- Definition and concepts of additive manufacturing (AM), Design for Additive Manufacturing, Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), Electron Beam Melting (EBM), Direct Metal Laser Sintering (DMLS), Binder Jetting, Material Jetting, Laminated Object Manufacturing (LOM), Hybrid Additive Manufacturing, Polymers, metals, ceramics, and composites used in additive manufacturing, Material properties and considerations for AM, Powder characteristics and requirements, Design principles for AM, Topology optimization, Support structures and build orientation, Design constraints and guidelines, Surface finishing techniques, Heat treatment and stress relief, Machining and polishing, Metal additive Manufacturing, Bio Printing.
- Basics of robotics and its applications, Classification of robots based on kinematics and control, Robot components and subsystems, Forward and inverse kinematics, Jacobian matrix and velocity analysis, Robot dynamics and control, Robot programming languages: teach pendant, high-level languages, Offline programming and simulation, Robot control using programming, Types of sensors used in robotics: position, proximity, vision, tactile, etc. Actuator types: electric motors, pneumatics, hydraulics, etc. Feedback and closed-loop

control, Programmable Logic Controllers (PLCs) and their programming, Control modes: position, velocity, force control, Trajectory planning and interpolation, PID control and other control strategies, Types of manipulators: serial, parallel, and SCARA, Grippers and end-effectors, Machine learning techniques, Artificial Intelligence in Robotics. Offline programming and simulation,

Robot control using programming, Types of sensors used in robotics: position, proximity, vision, tactile, etc. Actuator types: electric motors, pneumatics, hydraulics, etc. Feedback and closed-loop control, Programmable Logic Controllers (PLCs) and their programming, Control modes: position, velocity, force control, Trajectory planning and interpolation, PID control and other control strategies, Types of manipulators: serial, parallel, and SCARA, Grippers and end-effectors, Machine learning techniques, Artificial Intelligence in Robotics.

CENTRE OF EXCELLENCE IN WATER MANAGEMENT

Fluid Mechanics: Properties of fluids, Pressure and its measurement, Bouyancy and floatation, Hydrostatic forces on surfaces, Fluid kinematics and dynamics, Orifices, notches, weirs, Differential flow meters, Laminar and turbulent flow in pipes, Drag and lift, Flow in open channels, Dimensional and model analysis, Centrifugal pumps.

Hydrology: Precipitation and its measurement, Infiltration, Evaporation& transpiration, Run-off and its estimation, Hydrograph, S-curve, Unit hydrograph, Ground water flow analysis, Well hydraulics, flood estimation, routing and control, River meandering and training works.

Irrigation: Methods of irrigation, Water requirement of crops, Reservoir planning, Different dams and Spillways, Diversion head works, Canal designs, Canal lining and water logging, Cross drainage works, Sediment transport,.

Department of Chemical Engineering

Steady and unsteady state mass and energy balances including multiphase, multi-component, reacting and non-reacting systems. First and Second laws of thermodynamics, Applications of first law to close and open systems, Second law and Entropy, Fluid statics, surface tension, Newtonian and non-Newtonian fluids, transport properties, shell balances including differential form of Bernoulli equation and energy balance, equation of continuity, equation of motion, equation of mechanical energy, dimensional analysis and similitude, flow through pipeline systems, velocity profiles, flow meters, pumps and compressors, Equation of energy, steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption, membrane separations (micro-filtration, ultra-filtration, nano-filtration and reverse osmosis). Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, kinetics of enzyme reactions (Michaelis-Menten and Monod models), non-ideal reactors; residence time distribution, single parameter model; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis; rate and performance equations for catalyst deactivation.

Measurement of process variables; sensors and transducers; P&ID equipment symbols; process modeling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response,

Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, and discounted cash flow.

Inorganic chemical industries (sulfuric acid, phosphoric acid, chlor-alkali industry), fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers)

DEPARTMENT OF CHEMISTRY

Inorganic Chemistry

Chemical periodicity, Shapes of molecule (VSEPR Theory), structure and bonding in homo and heteronuclear molecules. Acid-Base theories: Hard-Soft Acid-Base (HSAB) concept, non-aqueous solvents. Main group elements: Industrial importance of compounds, bonding, allotropy, structure, and synthesis. Transition elements and coordination compounds: Bonding theories, reaction mechanisms, spectral and magnetic properties. Inner transition elements: Analytical applications, magnetic and spectral properties. Organometallic compounds: Bonding, structure, synthesis and reactivity, organometallics in homogeneous catalysis, metal clusters and cages. Analysis of inorganic compounds: Electro and thermo-analytical procedures, separation procedures; Characterization of inorganic compounds by IR, NMR, Raman and UV-vis spectroscopy. Bioinorganic Chemistry: Oxygen transport, electron-transfer reactions; nitrogen fixation, metal complexes in medicine. Nuclear chemistry:Activation analysis, radio-analytical techniques, fission and fusion reactions

Physical Chemistry

Quantum mechanics: Operator algebra, particles-in-a-box, harmonic oscillator, hydrogen atom; Approximations, like variational and perturbation theories up to the first degree of energy. Atomic structure; Term symbols; many-electron systems and antisymmetry concept, Huckel theory for conjugated π- electron systems. Chemical bonding: Elementary concepts of MO and VB theories; chemical bonding in diatomics. Group Theory: Point groups, character tables, chemical applications, symmetry elements, selection rules. Molecular spectroscopy: Selection rules for IR and Raman activities, electronic spectra, basic principles of rotational and vibrational spectra of diatomic molecules. Chemical thermodynamics: Temperature and pressure dependence of thermodynamic quantities; concept of equilibrium; Le Chatelier principle; thermodynamics of ideal and non-ideal solutions; phase equilibria and phase rule. Statistical thermodynamics: Model systems, partition functions and their relationships to thermodynamic quantities, Boltzmann distribution Electrochemistry: Ionic equilibria, electrolytic conductance, electrochemical cells, Nernst equation, redox systems, Kohlrausch's law and its applications, conductometric and potentiometric titrations.

Chemical kinetics: Steady state approximation, empirical rate laws and temperature dependence, unimolecular reactions, enzyme kinetics, salt effects, homogeneous catalysis. Colloids and surfaces: Heterogeneous catalysis, isotherms, stability and properties of colloids. Solid state: Crystal structures; band structure of solids, Bragg's law and applications.

Data analysis: Absolute and relative errors, mean, standard deviation of data.

Organic Chemistry

IUPAC nomenclature of organic molecules, Stereochemical principles: Diastereoselectivity, enantioselectivity, stereogenicity, stereoselectivity, configurational and conformational isomerism in acyclic and cyclic compounds.

Aromaticity: benzenoid and non-benzenoid compounds. Organic reactive intermediates: Free radicals, generation of benzynes, nitrenes, carbenes, carbanions, stability and reactivity of carbocations; Nucleophilic and electrophilic substitution reactions, determining the reaction pathways using organic reactive intermediates. Reagents and organic transformations: Rearrangements, common catalysts and reagents (organic, inorganic, organometallic and enzymatic), functional group inter conversions, like oxidations and reductions, stereoselective transformations

Organic synthesis: Umpolung of reactivity, linear and convergent synthesis, retrosynthesis and protecting groups. Asymmetric synthesis: Asymmetric induction methods- substrate, determination of enantiomeric and diastereomeric excess; reagent, and catalyst controlled reactions; enantio-discrimination, chiral auxiliaries. Pericyclic reactions: Sigmatropic rearrangements and other related concerned reactions, cycloaddition, and electrocyclization. Organic photochemistry. Heterocyclic chemistry: Reactivity and synthesis of heterocyclic compounds with one or two heteroatoms (O, N, S). Chemistry of natural products: Biogenesis of Terpene, steroids, fatty acids, alkaloids, nucleic acids, alkaloids, terpenes, proteins, and peptides. Spectroscopic techniques: UV-Vis, IR, 1H& 13C NMR and Mass; Structure determination of organic compounds.

Department of Civil Engineering

Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses. Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Construction Materials and Management: Construction Materials, Project planning and network analysis - PERT and CPM; Cost estimation. Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations –foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations –dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag. Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles. Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law. Irrigation: Types of irrigation systems and methods; Crop water requirements

- Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures. Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment. Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments. Geometric design of railway Track – Speed and Cant. Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design. Highway Pavements: Highway materials - desirable properties and tests; Design factors for flexible and rigid pavements; Design of flexible, and rigid pavement using IRC codes Traffic Engineering:

Traffic studies on flow and speed, peak hour factor, accident study, Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Photogrammetry, Remote Sensing , GIS and GPS.

DEPARTMENT OF COMPUER SCIENCE AND CENTRE OF AI

Discrete Mathematics: Sets, relations, functions, partial order. Graphs: connectivity, matching, coloring. Recurrence relations.

Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors.

Probability and Statistics: Mean, median, mode, and standard deviation. Conditional probability and Bayes theorem.

Boolean algebra. Combinational and sequential circuits. Number representation and computer arithmetic (fixed and floating point).

Machine instructions and addressing modes. ALU Instruction pipelining, pipelining hazard. Memory hierarchy: cache, main memory and secondary storage.

Programming in C, Recursion, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heap, graphs.

Searching, Sorting, hashing, Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths.

Regular expressions and finite automata, Context-free grammars and push-down automata. Regular and context-free languages. Lexical analysis, parsing, syntax-directed translation. Intermediate code generation. Code optimization

Processes, threads, inter-process communication, concurrency and synchronization, Deadlock, CPU scheduling. Memory management and virtual memory. File systems.

Relational model: relational algebra, SQL. Normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

OSI and TCP/IP protocol stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control; Routing protocols; IP addressing, IPV4, CIDR notation, Network Address Translation (NAT); Transport layer: flow control and congestion control; Application layer protocols: DNS, SMTP, HTTP, FTP.

Verbal aptitude, Quantitative aptitude, Analytical aptitude.

ENERGY CENTRE

1.	Energy for sustainable development, Energy security, Energy Economy Environ Linkages, Conventional Electrical Energy Generation, Fossil fuels, coal, petroleum natural gas etc., nuclear power generation, Principles of energy conversion systems suc Solar, Wind, Biomass, bio-energy and bio-fuels, Hydroelectric, Geothermal, O Thermal, Tidal, Estimation of available power, Load curves, load factor, diversity factor
2.	Solar cell Technologies PV Applications, Solar Thermal Conversion Devices Applications, Wind resource assessment, Wind Turbines, Biomass conversion proce combustion, gasification, pyrolysis, liquification. Biogas production, Gasifiers, methanation, urban waste Incineration plants, Landfill Gas plants, Liquid Bio F Fluidized Bed Combustion, Clean Coal Technologies, Hydrogen Production and Sto Methods, Fuel cell types and applications, electric vehicle- challenges, Energy sto techniques
3.	Power Electronic Controllers for energy conversion, Hybrid Energy Systems , Stand- a and grid connected energy systems, Smart grids and micro grids based on renewable pc sources, Mathematical simulation and optimization of energy systems, Software in En Systems
4.	Energy Conservation, Types of Energy Audit, Energy Management, Maximizing Sy Efficiencies, Energy conservation Act. energy conservation in Household, Transporta Agricultural, service and Industrial sectors, Lighting, Heating Ventilation & Conditioning. Optimizing the Input Energy Requirements, Energy Audit Instrum Economic Analysis
5.	Climate change and Carbon Sequestration, Net-Zero Emission, Global Energy Protoco Treaties-UNFCCC, Kyoto protocol, Joint Implementations, CDM, Carbon Trading, Ca Fund Programs, Energy policy of India, MNRE, Green Corridors, World Energy Co (WEC), International Energy Agency (IEA), ISA, BEE, IREDA

Department of Electrical Engineering

Section 1: Engineering Mathematics

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigenvalues, Eigenvectors.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line integral, Surface integral, Volume integral, Stokes's theorem, Gauss's theorem, Divergence theorem, Green's theorem.

Differential Equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's equation, Euler's equation, Initial and boundary value problems, Partial Differential Equations, Method of separation of variables.

Complex Variables: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, Laurent series, Residue theorem, Solution integrals.

Probability and Statistics: Sampling theorems, Conditional probability, Mean, Median, Mode, Standard Deviation, Random variables, Discrete and Continuous distributions, Poisson distribution, Normal distribution, Binomial distribution, Correlation analysis, Regression analysis.

Section 2: Electric circuits

Network Elements: ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem; Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-deltatransformation, complex power and powerfactor in ac circuits.

Section 3: Electromagnetic Fields

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

Section 4: Signals and Systems

Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Applications of Fourier Transform for continuous and discrete time signals, Laplace Transform and Z transform. R.M.S. value, average value calculation for any general periodic waveform.

Section 5: Electrical Machines

Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque- speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Typesof losses and efficiency calculations of electric machines.

Section 6: Power Systems

Basic concepts of electrical power generation, ac and dc transmission concepts, Models and performance of transmission lines and cables, Economic Load Dispatch (with and without considering transmission losses), Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss- Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Section 7: Control Systems

Mathematical modelling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems

Section 8: Electrical and Electronic Measurements

Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Section 9: Analog and Digital Electronics

Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications; single stage active filters, Active Filters: Sallen Key, Butterwoth, VCOs and timers, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.

Section 10: Power Electronics

Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Single and three-phase configuration of uncontrolled rectifiers; Voltage and Current commutated Thyristor based converters; Bidirectional ac to dc voltage source converters; Magnitude and Phase of line current harmonics for uncontrolled and thyristor based converters; Power factor and Distortion Factor of ac to dc converters; Single-phase and three- phase voltage and current source inverters, sinusoidal pulse width modulation.

Department of Electronics and Communication

SECTION A: General

Electronic Devices: P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED and photo diode

Analog Circuits Diode circuits: clipping, clamping and rectifiers. BJT and MOSFET amplifiers: biasing, ac coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers. Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

Digital Circuits Number representations: binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines.

Network Circuit analysis: Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform.

Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications. Auto correlation and power spectral density, properties of white noise, filtering of random signals through LTI systems

SECTION B: Communication and Signal Processing

Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay.

Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers.
Information theory and coding: entropy, conditional entropy, mutual information and channel capacity theorem. Fundamentals of error detection and correction, linear block codes, Hamming codes.

Digital communications: PCM, DPCM, delta modulation, digital modulation schemes (BASK, BPSK, BFSK, M-PSK, QAM), bandwidth, inter-symbol interference, MAP receiver, ML receiver, matchedfiltering, SNR vs BER.

Electromagnetics Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Light propagation in optical fibers, Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Optical sources and link design

Dipole and monopole antennas, linear antenna arrays.

SECTION C: VLSI

Synchronous Sequential Logic Circuit Design: Mealy and Mixed type Synchronous State Machines. Synchronous Counter Design, Hazards.

Asynchronous Sequential logic design: Primitive flow table and reduction, type of delays, Cycles and races, Hazards, Finite Sate Machines, Algorithmic State Machine, Fault Diagnosis, Fault modeling, levels of fault models, Single stuck-at fault model, Design for Testability.

Clocking strategies: Static Time Analysis, Setup and Hold Time. Programmable logic devices:

PALs, PLDs, CPLDs and FPGAs.

MOS Technology: Electrical Properties of MOS device, BiCMOS Technology, CMOS logic structures - Pseudo nMOS, dynamic CMOS, clocked CMOS, CMOS domino, NP-domino logic. Layout design rules, power estimation.

Department of Humanities and Social Sciences

English Syllabus

Major Topics	
1.	**Unit-1: English Literature** British Poetry, British Drama, British Novel, English Studies in India, Ind Writing in English, American Literature, American Literature, New Literatur English, American Novel, Contemporary Indian Literature in Engl Translation, Indian Folk Literature
2.	**Unit II: English Language** History of ELT in India, English as a Second Language/Foreign Langua English and Indian Languages, English as a Link Language and Offi Language, Language Policy of the Government, The English of Indians 'Indians' English', Teaching and Learning of English as an Internatio Language, Aspects of Language, Developing Language Skills, Methodology English, Teaching, Teaching Language through Literature
3.	**Unit III:Bi/Multilingualism and Bilingual Education** Bilingualism, Bilingualism in Indian Context, Types of Bilingualis Simultaneous/Sequential/ Societal/Individual, Bilingual Mind, Bilingualism Intelligence, Bilingual Education, Approaches to Bilingual Education, Mod of Bilingual Education, Mother tongue (L1), First Language, Second Langua Learning English in Multilingual/Multicultural Contexts
4.	**Unit IV: English Education** Understanding Education through a Psychological Perspective, Methods Importance of Educational Studies, Basic Concepts of Research Methodol and its Application in Education, Teacher Education, Inclusive Educati Distance Education and Open Learning, Educational Technology and I Curriculum Studies, Education Policy

Department of Humanities and Social Sciences

ECONOMICS

Unit-1: Microeconomics

- Theory of Consumer Behaviour
- Theory of Production and Costs
- Decision making under uncertainty Attitude towards Risk
- Game Theory – Non Cooperative games
- Market Structures, competitive and non-competitive equilibria and their efficiency properties
- Factor Pricing
- General Equilibrium Analysis
- Efficiency Criteria: Pareto-Optimality, Kaldor – Hicks and Wealth Maximization Welfare Economics: Fundamental Theorems , Social Welfare Function ·Asymmetric Information: Adverse Selection and Moral Hazard

Unit-2: Macroeconomics

- National Income: Concepts and Measurement
- Determination of output and employment: Classical & Keynesian Approach
- Consumption Function
- Investment Function
- Multiplier and Accelerator
- Demand for Money
- Supply of Money
- IS – LM Model Approach
- Inflation and Phillips Curve Analysis
- Business Cycles
- Monetary and Fiscal Policy
- Rational Expectation Hypothesis and its critique

Unit- 3: Statistics

- Probability Theory: Concepts of probability, Distributions, Moments, Central Limit theorem
- Descriptive Statistics – Measures of Central tendency & dispersions, Correlation, Index Numbers
- Sampling methods & Sampling Distribution
- Statistical Inferences, Hypothesis testing

Unit-4: Mathematical Economics

- Sets, functions and continuity, sequence, series
- Differential Calculus and its Applications
- Linear Algebra – Matrices, Vector Spaces
- Static Optimization Problems and their applications
- Input-Output Model, Linear Programming
- Difference and Differential equations with applications

Unit-5: International Economics

- International Trade: Basic concepts and analytical tools
- Theories of International Trade
- International Trade under imperfect competition
- Balance of Payments: Composition, Equilibrium and Disequilibrium and Adjustment Mechanisms
- Exchange Rate: Concepts and Theories
- Foreign Exchange Market and Arbitrage
- Gains from Trade, Terms of Trade, Trade Multiplier
- Tariff and Non-Tariff barriers to trade; Dumping
- GATT, WTO and Regional Trade Blocks; Trade Policy Issues
- IMF & World Bank

Unit-6: Public Economics

- Market Failure and Remedial Measures: Asymmetric Information, Public Goods, Externality
- Regulation of Market – Collusion and Consumers' Welfare ·Public Revenue: Tax & Non-Tax Revenue, Direct & Indirect Taxes, Progressive and non-Progressive Taxation, Incidence and Effects of Taxation
- Public expenditure
- Public Debt and its management
- Public Budget and Budget Multiplier
- Fiscal Policy and its implications

Unit-7: Money and Banking

- Components of Money Supply
- Central Bank
- Commercial Banking
- Instruments and Working of Monetary Policy
- Non-banking Financial Institutions
- Capital Market and its Regulation

Unit-8: Growth and Development Economics

- Economic Growth and Economic Development
- Theories of Economic Development: Adam Smith, Ricardo, Marx, Schumpeter, Rostow, Balanced & Unbalanced growth, Big Push approach.
- Models of Economic Growth: Harrod-Domar, Solow, Robinson, Kaldor
- Technical progress – Disembodied& embodied; endogenous growthIndicators of Economic Development: PQLI, HDI, SDGs
- Poverty and Inequalities – Concepts and Measurement
- Social Sector Development: Health, Education, Gender

Unit-9: Environmental Economics and Demography

- Environment as a Public Good
- Market Failure
- Coase Theorem
- Cost-Benefit Analysis and Compensation Criteria
- Valuation of Environmental Goods
- Theories of Population
- Concepts and Measures: Fertility, Morbidity, Mortality
- Age Structure, Demographic Dividend
- Life Table
- Migration

Unit-10: Indian Economy

- Economic Growth in India: Pattern and Structure
- Agriculture: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Industry: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Services: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Rural Development – Issues, Challenges & Policy Responses
- Urban Development – Issues, Challenges and Policy Responses.
- Foreign Trade: Structure and Direction, BOP, Flow of Foreign Capital, Trade Policies
- Infrastructure Development: Physical and Social; Public-Private Partnerships
- Reforms in Land, Labour and Capital Markets
- Centre-State Financial Relations and Finance Commissions of India; FRBM
- Poverty, Inequality & Unemployment

Unit-11: Econometrics

- Econometrics and its nature and scope; the nature, sources and types of data; the classical linear regression model (CLRM) assumptions; Best Linear Unbiased Estimator; R^2: a measure of goodness of fit of the estimated regression

- Perfect Vs. Imperfect Collinearity; Multicollinearity- Meaning, causes, consequences, detection and remedial measures- Heteroscedasticity- Meaning, causes, consequences, detection and remedial measures

- Autocorrelation- Meaning, causes, consequences, detection and remedial measures- Model Specification Errors- Meaning, causes, consequences, detection and remedial measures

- Endogeneity- Meaning, causes, consequences, detection and remedial measures- Time Series Econometrics: The importance of stationary time series; Tests of stationarity; The unit root test of stationarity; Trend stationary vs. difference stationary time series; The random walk model (RWM)

- Dummy variables and its use; The linear probability model (LPM); The logit model; The probit model

Department of Humanities and Social Sciences

Psychology Syllabus

Unit 1: Historical and Theoretical Foundations of Psychology

- Psychological thought in major Eastern Systems: Bhagavad Gita,Buddhism, Sufism, Integral Yoga
- Academic psychology in India: Pre-independence era, post-independence era, 1970s-2000s
- Western psychology: Greek heritage, medieval period, modern period
- Paradigms of Western Psychology: Positivism, Post-Positivism, Criticalperspective, Social Constructionism, Existential Phenomenology, Co- operative Enquiry
- Indic influences on modern psychology

Unit 2: Research Methodology and Statistics

- Research: Meaning, Purpose, Dimensions, Problems, Variables,Operational Definitions, Hypothesis, Sampling
- Ethics in research
- Paradigms of research: Quantitative, Qualitative, Mixed methods
- Methods of research: Observation, Survey, Experimental, Quasi- experimental, Field studies, Cross-Cultural Studies, Phenomenology, Grounded theory, Focus groups, Narratives, Case studies, Ethnography
- Statistics in Psychology: Measures of Central Tendency and Dispersion,Normal Probability Curve, Parametric and Non-parametric tests, Correlational Analysis, Regression, Factor analysis, Experimental Designs

Unit 3: Psychological Testing

- Types of tests
- Test construction: Item writing, item analysis
- Test standardization: Reliability, validity, Norms
- Areas of testing: Intelligence, creativity, neuropsychological tests,aptitude, Personality assessment, interest inventories
- Attitude scales, Computer-based psychological testing
- Applications of psychological testing

Unit 4: Biological Basis of Behavior

- Sensory systems
- Neurons: Structure, functions, types, neural impulse, synaptictransmission, Neurotransmitters
- Central and Peripheral Nervous Systems
- Neuroplasticity
- Methods of Physiological Psychology: Invasive and non-invasivemethods
- Muscular and Glandular system
- Biological basis of Motivation, Emotion
- Genetics and behavior

Unit 5: Attention, Perception, Learning, Memory, Forgetting

- Attention: Forms, Models
- Perception: Approaches, Perceptual Organization, PerceptualConstancy, Illusions, Perception of Form, Depth, Movement
- Signal detection theory, Subliminal perception, Pattern recognition,Ecological perspective
- Learning Process: Theories, Classical Conditioning, Instrumentallearning, Reinforcement, Cognitive approaches, Verbal learning
- Memory and Forgetting: Memory processes, Stages of memory,Theories of Forgetting

Department of Humanities & Social Sciences

PUBLIC-POLICY Syllabus

Unit: Introduction

Concepts of Public Policy - Nature, Scope and Significance of Public Policy, Definition and Types of Public Policy: Regulatory, Welfare, Distributive and Re- distributive – Evolution of Public Policy Studies – Public Policy Cycle, Models of Public Policy: Systems Model, Harold Lasswell, Herbert Simon, and Charles Lindblom.

Unit: Policy Making in India

Constitutional framework for Policy Making – Institutional Factors: Legislature, Executive, Judiciary, Planning Commission and National Development Council
– Other Forces in policy making: Public Opinion, Political parties, Pressure groups, NITI Ayog, Media and Professional Bodies - External Influencing Agencies: UNDP, WHO, ILO, UNEP, ADB, World Bank, and IMF - Policy Making process.

Unit: Policy Implementation

Public Policy Delivery Agencies and Implementers: Aspects of Policy Design for Implementation, Modes of Policy Delivery and Implementers, Enforcement Modes. Problems in Public Policy Implementation: Conceptual, Political and Administrative Problems, Conditions for Successful Implementation.

Unit: Policy Monitoring and Evaluation

Policy Monitoring: Approaches and Techniques, Constraints in Policy Monitoring, Measures for Effective Policy Monitoring - Policy Evaluation: Role, Process and Criteria, Types of Evaluation, Evaluating Agencies – Problems in Policy Evaluation.

Unit: Public Policies

Population Policy – Agrarian Policy - Education Policy - Health Policy-Rural Employment Policy, Economic Policy, New Education Policy.

Department of Humanities & Social Sciences

Sociology Syllabus

Unit I: Basic Concepts and Institutions

- Sociological Concepts
    - Social Structure, Culture, Network, Status and Role, Identity, Community, Diaspora
    - Values, Norms, and Rules, Personhood, Habitus, and Agency, Bureaucracy, Power, and Authority
- Social Institutions
    - Marriage, Family, and Kinship, Economy, Polity, Religion, Education, Law and Customs
- Social Stratification
    - Social Difference, Hierarchy, Inequality, and Marginalization
    - Caste and Class, Gender, Sexuality, and Disability, Race, Tribe, and Ethnicity

Unit II: Society, Human Behavior, and Communities

- Sociological Concepts: Social Structure, Social Institutions, Social Groups, Socialization, Social Control, and Social Change
- Approaches to the Study of Society: Functionalist, Conflict/Dialectical, Structuralism, and Post-Modernism
- Social System and Stratification: Major Social Systems (Family and Religion), Social Stratification (Marxist, Functionalist, and Weberian approach)
- Human Behavior: Normal and Abnormal Behavior, Life Span Perspective of Human Development
- Theories of Personality: Psychoanalytic, Behavioral, and Humanistic Theories
- Social Psychology: Social Perception, Attitude Formation, Change and Measurement, Communication, Theories of Collective Behavior
- Types of Communities: Rural, Urban, Tribal, and Virtual Communities, Vulnerable Groups (Women, Children, Aged, Dalits), Caste and Class Characteristics

Unit III: Social Work with Individuals and Groups

- Basic Social Case Work Concepts: Social Roles, Social Functioning, Need Assessment, Adaptation, Social Environment, Person-in-Environment Fit
- Approaches to Social Case Work Practice: Diagnostic and Functional Approach, Problem Solving, Task Centered, Radical Approach

- Process and Techniques of Social Case Work: Phases of Case Work Intervention, Techniques, Principles of Interviewing and Case Work Recording
- Social Group Work: Definition, Characteristics, Functions, Group Structure, Classification, Issues of Identity, Diversity, Marginalization
- Social Group Work Process and Group Dynamics: Principles, Determinants, Indicators, Outcomes, Decision Making, Problem Solving, Theories of Leadership
- Group Development: Stages, Techniques, Skills, Group Climate, Communication, Use of Media, Monitoring, and Evaluation
- Practice Sites of Social Case Work and Social Group Work: Client Groups, Various Settings

Unit IV: Research in Social Work: Quantitative and Qualitative Approaches

- Basics of Social Science Research: Meaning, Nature, Scope
- Steps in Social Science Research: Problem Identification, Literature Review, Objectives, Hypothesis Formulation, Research Design, Data Collection, Processing, Analysis, Report Writing
- Basic Statistical Concepts: Descriptive, Inferential Statistical Methods, Parametric, Non-Parametric Tests
- Qualitative Research: Meaning, Basic Tenets, Designing Qualitative Research, Methods, Managing Qualitative Data
- Mixed Method Research: Components, Procedures of Combining Quantitative and Qualitative Research

Unit V: Social Work with Communities and Social Action

- Community Organization: Concept, Scope, Historical Perspective, Role of Community-Based Organizations, Human Capital, Social Capital
- Process of Community Organization: Steps, Methods, Principles, Skills, Assumptions, Record Maintenance, Involving NGOs
- Approaches in Community Organization Practice: Models, Strategies, Leadership Development, Building Partnerships
- Social Action and Social Movements: Concept, History, Social Action as a Method, Models, Theories of Movement, New Social Movements
- Social Movements, Social Action, and Social Change: Movement Analysis, Ideology, Structure, Leadership, Outcomes, Analysis of Gandhi, Martin Luther King Jr., Frantz Fanon
- Social Action and Social Change: Movement Analysis, Ideology, Structure, Leadership, Outcomes, Analysis of Gandhi, Martin Luther King Jr., Frantz Fanon

Department of Management Studies

Management – Concept, Process, Theories and Approaches, Management Roles and Skills, Human Resource Management, Accounting Principles and Standards, Marketing – Concept, Orientation, Trendsand Tasks, Customer Value and Satisfaction, Consumer Behavior, Service Marketing, Marketing Research, Operations Management–Role and Scope, International Business, Strategic Management

Department of Materials and Metallurgical Engineering

Section 1: Physical Metallurgy

Chemical Bonding: lonic, covalent, metallic, and secondary bonding in materials, Crystal structure of solids - metals and alloys, ionic and covalent solids, and polymers.

X-ray Diffraction - Bragg's law, optical metallography, principles of SEM imaging.

Crystal Imperfections: Point, line and surface defects; Coherent, semi-coherent and incoherent interfaces.

Diffusion in Solids: Diffusion equation, steady state and error function solutions; Examples-homogenenization and carburization; Kirkendall effect; Uphill diffusion; Atomic models for interstitial and substitutional diffusion; Pipe diffusion and grain boundary diffusion.

Phase Transformation: Driving force, Homogeneous and heterogeneous nucleation, growth Kinetics Solidification in isomorphous, eutectic and peritectic systems, cast structures and macro segregation, dendritic solidification and constitutional super cooling, coring and micro segregation.

Solid State Transformations: Precipitation, spinoidal decomposition, ordering, massive transformation, discontinuous precipitation, eutectoid transformation, diffusion less transformations; Precipitate coarsening, Gibbs-Thomson effect.

Principles of heat treatment of steels, TTT and CCT diagrams; Surface hardening treatments; Recovery, recrystallization and grain growth; Heat treatment of cast iron and aluminium alloys. Electronic, magnetic and optical properties of materials.

Basic forms of corrosion and its prevention

Section 2: Mechanical Metallurgy

Strain tensor and stress tensor, Representation by Mohr's circle, elasticity, stiffness and compliance tensor, Yield criteria, Plastic deformation by slip and twinning.

Dislocation Theory: Edge, screw and mixed dislocations, source and multiplication of dislocations, stress fields around dislocations; Partial dislocations, dislocation interactions and reactions.

Strengthening Mechanisms: Work/strain hardening, strengthening due to grain boundaries, solid solution, precipitation and dispersion.

Fracture behaviour, Griffith theory, linear elastic fracture mechanics, fracture toughness, fractography, ductile to brittle transition.

Fatigue: Cyclic stress strain behaviour - low and high cycle fatigue, crack growth.

Mechanisms of high temperature deformation and failure; creep and stress rupture, stress exponent and activation energy.

Section 3: Manufacturing Processes

Metal Casting: Mould design involving feeding, gating and risering, casting practices, casting defects.

Hot, Warm and Cold Working of Metals: Metal forming - fundamentals of metal forming processes of rolling, forging, extrusion, wire drawing and sheet metal forming, defects in forming.

Metal Joining: Principles of soldering, brazing and welding, welding metallurgy, defects in welded joints in steels and aluminium alloys.

Powder Metallurgy: production of powders, compaction and sintering.

Department of Mathematics, Bioinformatics & computer Application (MBC)

MATHEMATICS STREAM

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and Series, convergence, limsup, liminf, Bolzano Weierstrass theorem, Heine Borel theorem, Continuity, differentiability, mean value theorem, Sequences and series of functions, Riemann sums and Riemann integral, Improper Integrals.

Ordinary Differential Equations (ODEs): Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs, Linear Differential Equation with constant coefficient of Higher Order.

Partial Differential Equations: Linear and nonlinear differential equation of first order methods Homogeneous and non-homogeneous differential equations of higher order, Classification of PDEs, Method of separation of variables for Laplace, Heat and Wave equations.

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series, Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Taylor series, Laurent series, calculus of residues, Conformal mappings.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements, Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots, Groups, subgroups, normal subgroups, quotient groups, homomorphism, cyclic groups, permutation groups, Cayley's theorem. Rings, Fields, finite fields, field extensions.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations, Algebra of matrices, rank and determinant of matrices, linear equations, Eigen values and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations, Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms

Numerical Analysis: Algebraic and transcendental equations, linearsimultaneous equations, Finite differences and interpolation, Numerical differentiation and integration, Numerical solutions of ODE.

Operations Research: Linear programming models, convex sets, Simplex method, Artificial Variable Techniques, revised Simplex method ; Duality theory, dual simplex method, sensitivity analysis, Integer programming problem (IPP), Transportation problems, Assignment problems.

Statistics: Measures of Dispersion, Correlation, Regression, Probability, Random Variable, Probability Distribution, Sampling, Testing of Hypothesis.

Department of Mathematics, Bioinformatics & computer Application (MBC)

BIOINFORMATICS STREAM

Introduction and Bioinformatics Resources: Definition, role, scope different areas and limitations of Bioinformatics, Biological data & databases, Basic of Genomics and Proteomics.

Biological sequence analysis and Alignment: Algorithms for pairwise and multiple sequence alignment, concept of gaps, gap-penalties scoring matrices, Probabilistic methods including hidden markov models, pattern matching, entropy measures, evolutionary models, and phylogeny.

Structural Bioinformatics: Basic properties associated with nucleic acid and proteins structures, RNA folding, RNA loops, Experimental methods available for structural determination of nucleic acids and proteins, Computational methods for structure validation, protein fold prediction. Tools for predicting biological functions from structures, Molecular docking – concept and methods. Drug Discovery and drug Designing.

Molecular Phylogenetic: Principles of Molecular Evolution and Molecular Phylogenetics, Nomenclature, representation, and general concepts of tree structure, Phylogenetic Tree Construction Methods and Programs.

Statistical techniques commonly used in biological analysis: Neural Networks, Support Vector Machines, Supervised and unsupervised Learning, Kernel Methods, Normalization of Gene Expression Data, Classification of Gene Expression Data, Statistical Analysis with the Gene Ontology, Classification of Protein Structures, Statistical methods associated with the analysis of microarray and next generation sequencing (NGS) data. Uni and multivariate analysis (e.g. ANOVA, correlation, regression, clustering).

Modeling of Biological systems: Basic idea of modeling of biological systems, properties of cell components (such as enzyme kinetics), mass and energy balances, stoichiometry and constraint-based modelling, kinetic modelling, Metabolic Control Analysis.

Mathematics: Basic of Differential and Integral calculus, Linear Algebra, Matrices, Interpolation, Solution of algebraic and Transcendental Equations, Basic of ordinary differential equations.

Basic of Computer Science: Data types, programming languages, Algorithms,Operating systems, Application and system softwares, data structures, components of computer hardware and software, compilers, interpreter, Scripting languages.

Department of Mathematics, Bioinformatics & computer Application (MBC)

COMPUTER APPLICATIONS STREAM

Discrete Mathematics

Propositional and First-Order Logic Sets, Relations, Functions, Partial Orders, and Lattices, Combinatorics, Counting, Recurrence Relations, Generating Functions.

Linear Algebra

Matrices, Determinants, System of Linear Equations, Eigenvalues and Eigenvectors.

Probability and Statistics

Measures of Dispersion, Correlation, Regression, Probability, Random Variable, Probability Distribution.

Digital Logic and Design

Boolean algebra, Combinational and Sequential Circuits, Minimization, Number Representations and Computer Arithmetic (Fixed and Floating Point)

Programming and Data Structures

Recursion, Arrays, Stacks, Queues, Linked Lists, Trees, Binary Search Trees, Binary Heaps, Graphs

Algorithms

Searching, Sorting, Hashing, Asymptotic notations, Time and Space Complexity, Algorithm Design Techniques: Greedy, Dynamic Programming, and Divide-and-Conquer,Graph Traversals, Minimum Spanning Trees, Shortest Paths

Theory of Computation

Regular Expressions and Finite Automata, Context-Free Grammar and Push-Down Automata, Regular and Context-Free Languages, Pumping Lemma, Turing Machines and Undecidability

Compiler Design

Lexical Analysis, Parsing, Syntax-Directed Translation,Runtime Environments, Intermediate Code Generation,Local Optimization.

Operating System

System Calls, Processes, Threads,Inter-Process Communication, Concurrency, and Synchronization, Deadlock, CPU and I/O Scheduling, Memory Management and Virtual Memory,File Systems

Databases

ER-Model, Relational Model: Relational Algebra, Tuple Calculus, SQL ,Integrity Constraints, Normal Forms, File Organization, Indexing (e.g., B and B+ Trees),Transactions and Concurrency Control

Computer Networks

Concept of Layering: OSI and TCP/IP Protocol Stacks,Basics of the Packet, Circuit, and Virtual Circuit Switching, Data Link Layer: Framing, Error Detection, Medium Access Control, Ethernet Bridging, Routing Protocols: Shortest Path, Flooding, Distance Vector, and Link State Routing, Fragmentation and IP Addressing, IPv4, CIDR Notation.

DEPARTMENT OF MECHANICAL ENGINEERING

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamicanalysisoflinkages;cams;gearsandgeartrains;flywheelsandgovernors;balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree offered om systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

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

Fluid Mechanics: Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differentialequationsofcontinuityandmomentum;Bernoulli'sequation;dimensionalanalysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.

Heat Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parametersystem,Heisler'scharts;thermalboundarylayer,dimensionlessparametersinfree and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat.

I.C. Engines: Air-standard Otto, Diesel and dual cycles.

Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes.

Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

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

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Orthogonal and oblique machining, Single point cutting tool and tool signature, Chip formation, cutting forces, Merchant's analysis, Specific cutting energy and power; Machining parameters and material removal rate; tool materials, tool wear and tool life; Thermal aspects of machining, cutting fluids, machinability; Economics of machining; Machining processes – turning, taper turning, thread cutting, drilling, boring, milling, gear cutting, thread production; Finishing processes – grinding, honing, lapping and super finishing. principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

Advanced Manufacturing: Principles and applications of USM, AJM, WJM, AWJM, EDM and Wire EDM, LBM, EBM, PAM, CHM, ECM; Effect of process parameters on material removal rate, surface roughness and power consumption; Additive manufacturing techniques. Definition and concepts of additive manufacturing (AM), Design for Additive Manufacturing, Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), Electron Beam Melting (EBM), Direct Metal Laser Sintering (DMLS), Binder Jetting, Material Jetting, Laminated Object Manufacturing (LOM), Hybrid Additive Manufacturing, Polymers, metals, ceramics, and composites used in additive manufacturing, Material properties and considerations for AM, Powder characteristics and requirements, Design principles for AM, Topology optimization, Support structures and build orientation, Design constraints and guidelines, Surface finishing techniques, Heat treatment and stress relief, Machining and polishing, Metal additive Manufacturing, Bio Printing.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly;

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools; additive manufacturing.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.
Inventory Control : Deterministic models; safety stock inventory control systems.

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

DEPARTMENT OF PHYSICS

1: Mathematical Physics

Vector calculus: linear vector space: basis, orthogonality and completeness; matrices; similarity transformations, diagonalization, eigen values and eigen vectors; linear differential equations: second order linear differential equations and solutions involving special functions; complex analysis: Cauchy-Riemann conditions, Cauchy's theorem, singularities, residue theorem and applications; Laplace transform, Fourier analysis; elementary ideas about tensors: covariant and contravariant tensors.

2: Classical Mechanics

Lagrangian formulation: D'Alembert's principle, Euler-Lagrange equation, Hamilton's principle, calculus of variations; symmetry and conservation laws; central force motion: Kepler problem and Rutherford scattering; small oscillations: coupled oscillations and normal modes; rigid body dynamics: interia tensor, orthogonal transformations, Euler angles, Torque free motion of a symmetric top; Hamiltonian and Hamilton's equations of motion; Liouville's theorem; canonical transformations: action-angle variables, Poisson brackets, Hamilton-Jacobi equation.

Special theory of relativity: Lorentz transformations, relativistic kinematics, mass-energy equivalence.

3: Electromagnetic Theory

Solutions of electrostatic and magnetostatic problems including boundary value problems; method of images; separation of variables; dielectrics and conductors; magnetic materials; multipole expansion; Maxwell's equations; scalar and vector potentials; Coulomb and Lorentz gauges; electromagnetic waves in free space, non-conducting and conducting media; reflection and transmission at normal and oblique incidences; polarization of electromagnetic waves; Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge.

4: Quantum Mechanics

Postulates of quantum mechanics; uncertainty principle; Schrodinger equation; Dirac Bra-Ket notation, linear vectors and operators in Hilbert space; one dimensional potentials: step potential, finite rectangular well, tunneling from a potential barrier, particle in a box, harmonic oscillator; two and three dimensional systems: concept of degeneracy; hydrogen atom; angular momentum and spin; addition of angular momenta; variational method and WKB approximation, time independent perturbation theory; elementary scattering theory, Born approximation; symmetries in quantum mechanical systems.

5: Thermodynamics and Statistical Physics

Laws of thermodynamics; macrostates and microstates; phase space; ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck's distribution law; Bose Einstein condensation; first and second order phase transitions, phase equilibria, critical point.

6: Atomic and Molecular Physics

Spectra of one-and many-electron atoms; spin-orbit interaction: LS and jj couplings; fine and hyperfine structures; Zeeman and Stark effects; electric dipole transitions and selection rules; rotational and vibrational spectra of diatomic molecules; electronic transitions in diatomic molecules, Franck-Condon principle; Raman effect; EPR, NMR, ESR, X-ray spectra; lasers: Einstein coefficients, population inversion, two and three level systems.

7: Solid State Physics

Elements of crystallography; diffraction methods for structure determination; bonding in solids; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids: nearly free electron and tight binding models; metals, semiconductors and insulators; conductivity, mobility and effective mass; Optical properties of solids; Kramer's-Kronig relation, intra- and inter-band transitions; dielectric properties of solid; dielectric function, polarizability, ferroelectricity; magnetic properties of solids; dia, para, ferro, antiferro and ferri-magnetism, domains and magnetic anisotropy; superconductivity: Type-I and Type II superconductors, Meissner effect, London equation, BCS Theory, flux quantization.

8: Electronics

Semiconductors in equilibrium: electron and hole statistics in intrinsic and extrinsic semiconductors; metal-semiconductor junctions; Ohmic and rectifying contacts; PN diodes, bipolar junction transistors, field effect transistors; negative and positive feedback circuits; oscillators, operational amplifiers, active filters; basics of digital logic circuits, combinational and sequential circuits, flip-flops, timers, counters, registers, A/D and D/A conversion.

9: Nuclear and Particle Physics

Nuclear radii and charge distributions, nuclear binding energy, electric and magnetic moments; semi-empirical mass formula; nuclear models; liquid drop model, nuclear shell model; nuclear force and two nucleon problem; alpha decay, beta-decay, electromagnetic transitions in nuclei; Rutherford scattering, nuclear reactions, conservation laws; fission and fusion; particle accelerators and detectors; elementary particles; photons, baryons, mesons and leptons; quark model; conservation laws, isospin symmetry, charge conjugation, parity and time-reversal invariance