

Ph.D. PROGRAMME: 2017-18

List for Written Entrance Examination, Examination Schedule and Important Information

GENERAL INSTRUCTIONS

A help desk will be opened at the e-mail address phdadmhhelpju@gmail.com for answering queries related to admission to PhD under Faculty of Engineering. The desk will remain open till February 28, 2018 up to 17:30 hrs.

The admission is a two-step process for non-GATE candidates consisting of a written screening stage and a presentation and interview stage for the candidates qualifying the written test.

The admission of GATE candidates is purely through presentation and interview.

THERE IS NO PROVISION OF INSTITUTE SCHOLARSHIP TO ANY SELECTED CANDIDATE.

Candidates must report for the written test, if necessary, and the presentation-cum-interview, each time with a copy of Acknowledgement Receipt and a Government approved Photo ID card.

FOR GATE CANDIDATES

List of Eligible candidates called for Presentation and Interview to be conducted in respective department from March 15 to March 17, 2018 will be published in the University website later.

FOR NON-GATE CANDIDATES

Applicants/Students are requested to note the following:

- (a) TABLE 1 below provides the schedule of Entrance Test of Ph.D. Programme for the session 2017-18 without Institute Scholarship.
- (b) TABLE 2 below provides department-wise list of applicants eligible for the written test.
- (c) ANNEXURE 1 below provides the department-wise syllabus for the written test for each course.
- (d) Full Marks for Entrance Examination will be 100 and there will be 50 Multiple Choice Questions (25 questions on Research Methodology and 25 questions for relevant course or subject).
- (e) Two (2) marks will be allotted for each question
- (f) 0.25 marks will be deducted for each wrong answer
- (g) There will be no deduction for any question not attempted
- (h) No electronic gadget will be allowed in examination hall
- (i) Further instruction specific to some departments are given at appropriate place in ANNEXURE - 1.
- (j) Qualifying marks of Ph.D. entrance examination is 50 for General Category applicants and 40 marks for Reserve Category applicants, out of full marks of 100.

(k) List of the qualified candidates will be published in the University website in 13th March, 2018 (tentatively).

(l) Presentation and Interview of qualified candidates of the above Written Entrance Examination will be conducted on 15th, 16th and 17th March, 2018. Detailed schedule of presentation and interview in the respective Department will be displayed on the University website later.

TABLE 1: WRITTEN EXAMINATION SCHEDULE FOR Ph.D. ENTRANCE - 2017-18

Sl. No.	Department	Date of Examination	Time	Venue
1	Electrical Engg.	5 th March, 2018	11-00 a.m. to 12-00 noon	Elect. Engg. Dept.
2	Computer Sc. & Engg.	5 th March, 2018	12-30 p.m. to 1-30 p.m.	Computer Sc. & Engg. Dept.
3	Mechanical Engg	5 th March, 2018	2-00 p.m. to 3-00 p.m.	Mech. Engg. Dept
4	Civil Engg.	5 th March, 2018	3-30 p.m. to 4-30 p.m.	Civil Engg. Dept.
5	Production Engg.	6 th March, 2018	11-00 a.m. to 12 noon	Prod. Engg. Dept.
6	Pharmacy	6 th March, 2018	12-30 p.m. to 1-30 p.m.	Pham. Tech. Dept
7	Chemical Engg.	6 th March, 2018	2-00 p.m. to 3-00 p.m.	Chemical Engg. Dept.
8	Metallurgy & Material Engg.	6 th March, 2018	3-30 p.m. to 4-30 p.m.	Met. & Mat. Engg. Dept.
9	Instrumentation & Electronics Engg.	7 th March, 2018	10-30 a.m. to 11-30 a.m.	I.E.E. Dept.
10	Information Tech.	7 th March, 2018	12 noon to 1-00 p.m.	I.T. Dept.
11	Power Engg.	7 th March, 2018	1-30 p.m. to 2-30 p.m.	Power Engg. Dept.
12	Construction Engg.	7 th March, 2018	3-00 p.m. to 4-00 p.m.	Const. Engg. Dept.
13	Printing Engg.	7 th March, 2018	4-30 p.m. to 5-30 p.m.	Printing Engg. Dept
14	Electronics & Tele-Comm. Engg.	8 th March, 2018	11-00 a.m. to 12-00 noon	E.T.C.E. Dept.
15	Architecture	8 th March, 2018	12-30 p.m. to 1-30 p.m.	Architecture Dept.
16	Food Tech. & Biochemical Engg.	8 th March, 2018	2-00 p.m. to 3-00 p.m.	F.T.B.E. Dept.

TABLE 2: LIST OF APPLICANTS ELIGIBLE FOR THE WRITTEN Ph.D. ENTRANCE EXAMINATION - 2017-18

ARCHITECTURE DEPARTMENT

Sl No.	Application No.	Name	Category
1	PHDEARC17000276	NAMRATA TALUKDAR	General
2	PHDEARC17001296	FARHA SHERMIN	General

CHEMICAL ENGINEERING DEPARTMENT

Sl. No.	Application No	Name	Category
1	PHDECHE17000649	ANIK BHATTACHARYA	GENERAL
2	PHDECHE17001454	POULOMI SARKAR	GENERAL
3	PHDECHE17000036	ABHINANDA SENGUPTA	GENERAL
4	PHDECHE17001149	SNIGDHA MANDAL	Scheduled Caste

Hard copies of application forms have not been received by CHEMICAL ENGINEERING DEPARTMENT, for these candidates. These candidates are advised to bring copies of their application forms, along with the supporting documents, at the time of the written test.

CIVIL ENGINEERING DEPARTMENT:

Sl. No.	Application No	Name	Category
1	PHDECIV17000059	KAUSIK BERA	General
2	PHDECIV17001246	PRANAB DAS	General
3	PHDECIV17001308	SWAGATA DEBROY	General
4	PHDECIV17001622	DEBLEKHA KONAR	General
5	PHDECIV17001630	ROMILA RAY	General
6	PHDECIV17001291	SAHNEWAJ SIDDIQUI	OBC - A
7	PHDECIV17001337	NASIM AKHTAR	OBC - A
8	PHDECIV17001923	HASAN LASKAR	OBC - A
9	PHDECIV17001599	ROHAN PAUL	OBC - B
10	PHDECIV17001506	TAMAL KUNDU	OBC - B
11	PHDECIV17001941	RAMA PRAMANICK	SC

COMPUTER SCIENCE & ENGINEERING DEPARTMENT

Sl. No.	Application No	Name	Category
1	PHDECSE17000020	DEBATRI CHATTERJEE	General
2	PHDECSE17000903	MONU BHAGAT	OBC - B
3	PHDECSE17000970	RAJAT SUBHRA GHOSH	General
4	PHDECSE17001005	PURNENDU BIKASH CHATTERJEE	General
5	PHDECSE17001016	ANINDITA DESARKAR	General
6	PHDECSE17001031	SHISNA SANYAL	General
7	PHDECSE17001059	SANTANU MANDAL	OBC - B
8	PHDECSE17001065	GOPAL CHANDRA JANA	General
9	PHDECSE17001089	AYAN PRADHAN	General
10	PHDECSE17001114	ANUPAM PURKAIT	General
11	PHDECSE17001172	SUBRATA DAS	General
12	PHDECSE17001186	SUMANTA KUILA	General
13	PHDECSE17001230	PRAMIT KUMAR PAL	General
14	PHDECSE17001237	SUDIPTA BHADRA	General
15	PHDECSE17001279	KESHAV SINHA	General
16	PHDECSE17001280	DEBASHIS GHOSH	General
17	PHDECSE17001311	SANDIPAN BISWAS	General
18	PHDECSE17001324	SANKAR KARMAKER	Scheduled Caste
19	PHDECSE17001366	SASWATI NASKAR	Scheduled Caste
20	PHDECSE17001370	BISWARUP DUTTA	General
21	PHDECSE17001383	ARUNABHA TARAFDAR	General
22	PHDECSE17001384	BANIBRATA PAUL	General
23	PHDECSE17001392	SUKANYA ROY	General
24	PHDECSE17001397	ANIMESH KAR	General
25	PHDECSE17001430	TANUSREE PARBAT	Scheduled Caste
26	PHDECSE17001439	SHIBSANKAR BALA	General
27	PHDECSE17001449	MANAS GHOSH	General
28	PHDECSE17001494	ASHMITA DEY	General
29	PHDECSE17001497	PROTON SARKAR	OBC - A
30	PHDECSE17001504	CHANDRAMA DEY	General
31	PHDECSE17001509	ANANYA BANERJEE	General
32	PHDECSE17001512	SOM BANERJEE	General
33	PHDECSE17001534	PRIYANKA SIKDAR (SARKAR)	General
34	PHDECSE17001539	SINJINI BANERJEE	General
35	PHDECSE17001550	TAPAS HALDER	Scheduled Caste
36	PHDECSE17001558	HIRAK BANERJEE	General
37	PHDECSE17001567	ANIRBAN SAHA	Scheduled Caste
38	PHDECSE17001623	ATREYEE DATTA	General
39	PHDECSE17001651	DEBARSHI MAZUMDER	General

40	PHDECSE17001656	SOMA HAZRA	General
41	PHDECSE17001662	ATAUL HOQUE MANDAL	OBC - A
42	PHDECSE17001691	JAYITA MANDAL	General
43	PHDECSE17001717	HIMADRI SEKHAR ROY	General
44	PHDECSE17001730	KALPITA DUTTA	General
45	PHDECSE17001735	SUMIT NASKAR	Scheduled Caste
46	PHDECSE17001744	AYAN LAHIRI	General
47	PHDECSE17001754	PIYALI CHANDRA	General
48	PHDECSE17001789	ARUNABHA SAHA	General
49	PHDECSE17001790	DEBADITYA KUNDU	General
50	PHDECSE17001791	SUBHAS CHANDRA NATH	General
51	PHDECSE17001798	SUBRATA MALLIK	General
52	PHDECSE17001836	ABHISHEK DAS	General
53	PHDECSE17001848	PRIYAJIT SEN	General
54	PHDECSE17001882	SHOUVIK DATTA CHOUDHURY	General
55	PHDECSE17001934	UMA DEY	General
56	PHDECSE17001966	SANTU DHARA	General
57	PHDECSE17001968	SOMALINA CHOWDHURY	General
58	PHDECSE17001973	JHULAN MAJI	General
59	PHDECSE17001980	TANIK SAIKH	OBC - A
60	PHDECSE17001983	ABHIJIT BANDYOPADHYAY	General
61	PHDECSE17001985	HARSH SAHAY	General
62	PHDECSE17002018	MAYUKH RATH	General

CONSTRUCTION ENGINEERING DEPARTMENT

SL NO	APPLICATION NO	NAME	CATEGORY
1	PHDECON17001482	PATHIK DEBMALLIK	GENERAL
2	PHDECON17001463	MANOJ KUMAR SAHIS	SC
7	PHDECON17001479	ROHAN DATTA	GENERAL
8	PHDECON17001417	SUKAMAL KANTA GHOSH	GENERAL
11	PHDECON17001569	SUDIPTA ADHIKARY	GENERAL
12	PHDECON17001818	ALINDA DEY	GENERAL
13	PHDECON17001942	RAMA PRAMANICK	SC
14	PHDECON17001853	VICTOR CHAKRABORTY	GENERAL
17	PHDECON17001870	INDRAJIT KARMAKAR	* Provisionally allowed for admission test subject to verification of the hard copy documents, not available at present

ELECTRICAL ENGINEERING DEPARTMENT

Sl. No.	Application No	Name	Category
1	PHDEELE17000455	SOMA BORAL **	General
2	PHDEELE17001537	HIMADRI SEKHAR CHATTERJEE **	General
3	PHDEELE17001644	MOUBANI BANDYOPADHYAY **	General
4	PHDEELE17001856	SUMAN BHOWMICK **	General
5	PHDEELE17000923	DEEP MUKHERJEE	General
6	PHDEELE17001100	DEBIPRASANNA DAS	General
7	PHDEELE17001578	SWAPAN SANTRA	General
8	PHDEELE17001460	MONALISA DATTA	General
9	PHDEELE17000969	TAMAL BHATTACHARYA	General
10	PHDEELE17001447	KRISHNA RAO CHALLA	General
11	PHDEELE17001371	SWATI SUMAN	General
12	PHDEELE17001217	SANGHAMITRA MANNA	General
13	PHDEELE17001452	TASMITA SAHA	General
14	PHDEELE17001284	MAYANK KUMAR GAUTAM	General
15	PHDEELE17001262	SUMITA GOSWAMI	General
16	PHDEELE17001450	SUBHAJIT BHOWMICK	SC
17	PHDEELE17001223	SOUMEN GHOSH	General
18	PHDEELE17001251	RAHUL PANDIT	General
19	PHDEELE17001356	ARIJIT GHOSH	General
20	PHDEELE17001490	AMITAVA HATIAL	General
21	PHDEELE17001432	SANKHADIP SAHA	General
22	PHDEELE17001459	SREEJA CHAKRABORTY	General
23	PHDEELE17001465	MOUMITA MUKHERJEE	General
24	PHDEELE17001293	RUPAM KUMAR CHATTERJEE	General
25	PHDEELE17001306	DIPANKAR BISWAS	General
26	PHDEELE17001566	SUPRATIK DATTA	General
27	PHDEELE17001557	BIRAJ GUHA	General
28	PHDEELE17001574	ANINDITA BANERJEE	General
29	PHDEELE17001335	MOLAY KUMAR LAHA	General
30	PHDEELE17001765	SANTANU KOLA	General
31	PHDEELE17001474	SOUMYA DAS	General
32	PHDEELE17001611	SUMAN KHAN	General
33	PHDEELE17001442	SOUMADEEP GOSWAMI	General
34	PHDEELE17001629	SHIBAJI MONDAL	General
35	PHDEELE17001915	KALYAN BISWAS	General

36	PHDEELE17001613	PALLAV DUTTA	General
37	PHDEELE17001922	BISWAJIT BISWAS	General
38	PHDEELE17001679	SANDIP JANA	General
39	PHDEELE17001724	USHNIK CHAKRABARTI	General
40	PHDEELE17001733	AMIT DEBNATH	General
41	PHDEELE17001806	SWATILEKHA DAS	General
42	PHDEELE17001810	RAJ KUMAR ROY	SC
43	PHDEELE17001819	ARIJIT DAS	General
44	PHDEELE17001826	RAKESH DAS	General
45	PHDEELE17001839	BEVARA SRIKANTH	General
46	PHDEELE17001925	HIMANSU BHUSHAN MOHAPATRA	General
47	PHDEELE17001933	PARTHA SARATHI DAS	General
48	PHDEELE17001956	KRISHANLAL ADHIKARI	General
49	PHDEELE17001977	SURAVI THAKUR	General
50	PHDEELE17002027	KAUSHIK SIT	SC
51	PHDEELE17002028	KAUSHIK SIT	SC
52	PHDEELE17000991	PRABIR RANJAN KASARI	SC

**** Hard copies of application forms have not been received by the EE department, for these candidates. These candidates are advised to bring copies of their application forms, along with the supporting documents, at the time of the written test.**

ELECTRONICS & TELECOMMUNICATION ENGINEERING DEPARTMENT

Sl. No.	Application No	Name	Category
1.	PHDEETC17001604	RINKU RANI DAS	Scheduled Caste
2.	PHDEETC17001989	SAYANI BINDAI	Scheduled Caste
3.	PHDEETC17001543	SUVADRA MONDAL	OBC - B (NCL)
4.	PHDEETC17001945	KHAN MASOOD PARVEZ	OBC – B
5.	PHDEETC17001255	ANUP DEY	General
6.	PHDEETC17001270	SHOUVIK SARKAR	General
7.	PHDEETC17001273	ANJUMANARA BEGAM	General
8.	PHDEETC17001289	SOUMISHILA MITRA	General
9.	PHDEETC17001292	SUBHABRATA DHAR	General
10.	PHDEETC17001297	LAXMIPRIYA MOHARANA	General
11.	PHDEETC17001304	PULAKESH ROY	General
12.	PHDEETC17001305	RANJAN CHAKRABORTY	General
13.	PHDEETC17001364	SUNIPA GHOSH	General
14.	PHDEETC17001378	BIPLAB BAG	General
15.	PHDEETC17001436	KHUSHBU	General
16.	PHDEETC17001487	MOUMITA BASAK	General
17.	PHDEETC17001488	NAMRATA SHAW	General
18.	PHDEETC17001491	ANIRBAN DUTTA CHOUDHURY	General
19.	PHDEETC17001502	AMRITA CHATTERJEE	General
20.	PHDEETC17001518	SUMANT KUMAR MOHAPATRA	General
21.	PHDEETC17001521	ASISH HAZRA	General
22.	PHDEETC17001524	SABYASACHI PANCHADHYAYEE	General
23.	PHDEETC17001529	AMARTYA ACHARYA	General
24.	PHDEETC17001564	DEBARATI CHAUDHURI	General
25.	PHDEETC17001580	MAMANI BANDYOPADHYAY	General
26.	PHDEETC17001625	ANTARIPA BHUYAN	General
27.	PHDEETC17001670	SWAGATO DAS	General
28.	PHDEETC17001695	MAMONI MONDAL	General
29.	PHDEETC17001696	SREYA GHOSH	General
30.	PHDEETC17001829	SWETA SARITA SARANGI	General
31.	PHDEETC17001832	INDRANIL LAHIRI	General
32.	PHDEETC17001837	SAYANI GHOSH	General
33.	PHDEETC17001924	HIMANSU BHUSHAN MOHAPATRA	General
34.	PHDEETC17001927	DEBALINA ROY CHOUDHURY	General
35.	PHDEETC17001932	PARTHA SARATHI DAS	General
36.	PHDEETC17001952	SHUBHAJIT DATTA	General
37.	PHDEETC17001963	SUSOVAN MONDAL	General
38.	PHDEETC17001974	ASHIRWAD DUTTA	General
39.	PHDEETC17001999	SAYANTI HAZRA	General
40.	PHDEETC17002016	HIMELI CHAKRABARTI	General
41.	PHDEETC17002031	VIDYADHAR	General

II. The following candidates didn't submit the required hardcopy documents to the office of the Faculty of Engineering & Technology (FET), JU within the due date. They will be permitted to appear for the written test subject to verification of their educational qualifications and fulfilling the minimum eligibility criteria as per the FET guidelines:

Sl. No.	PhD Application No.	Name of the Candidate	Category
1	PHDEETC17000019	SUPARBA TAPNA	Scheduled Tribe
2	PHDEETC17001827	MANISH SINGH	OBC - A (Non-creamy Layer)
3	PHDEETC17001022	DIVYA KRISHNAKUMAR RAO	General
4	PHDEETC17002013	SATYANARAYAN PRADHAN	General (SC Orissa)
5	PHDEETC17001462	RIMI SENGUPTA	General
6	PHDEETC17001559	SOUVIK PHADIKAR	General
7	PHDEETC17001643	MOUBANI BANDYOPADHYAY	General
8	PHDEETC17001931	DEBASHISH PAL	General

FOOD TECHNOLOGY & BIOCHEMICAL ENGINEERING

Sl. No.	Application No	Name	Category
1.	PHDEFTB17000100	MAUSUMI RAY	GENERAL
2.	PHDEFTB17001823	SANCHITA SINHA	GENERAL

INFORMATION TECHNOLOGY DEPARTMENT

Sl. No.	Application No	Name	Category
1.	PHDEITE17000976	TANMOY CHAKRABARTI	General
2.	PHDEITE17001011	HIREN DUTTA	General
3.	PHDEITE17001369	DEBASHIS GHOSH	General
4.	PHDEITE17001373	ABHIJAN BHATTACHARYYA	General
5.	PHDEITE17001385	BANIBRATA PAUL	General
6.	PHDEITE17001399	JAHIRUDDIN AHAMED	General
7.	PHDEITE17001426	PRAGMA KAR	General
8.	PHDEITE17001433	DEBADREETA DAS	General
9.	PHDEITE17001498	AMIT KHAN	General
10.	PHDEITE17001649	DEBARSHI MAZUMDER	General
11.	PHDEITE17001743	AYAN LAHIRI	General
12.	PHDEITE17001809	PIYALI CHAKRABORTY	General
13.	PHDEITE17001914	KALYAN BISWAS	General
14.	PHDEITE17001938	SUBARNA DUTTA	General
15.	PHDEITE17001939	JOY ADHIKARY	General
16.	PHDEITE17001940	PRADIPTA CHOWDHURY	General
17.	PHDEITE17001982	ABHIJIT BANDYOPADHYAY	General
18.	PHDEITE17002007	SANCHAYAN BHAUMIK	General
19.	PHDEITE17002024	DEEPNANDA RAY	General
20.	PHDEITE17000906	MONU BHAGAT	OBC - B
21.	PHDEITE17001752	SUDIPTA SIKDAR	Scheduled Caste

INSTRUMENTATION & ELECTRONICS ENGINEERING DEPARTMENT

Sl. No.	Application No	Name	Category
01.	PHDEIEE17001193	MAHUYA BHATTACHARYYA BANERJEE	GENERAL
02.	PHDEIEE17001184	BARNALI GHATAK	GENERAL
03.	PHDEIEE17001216	SANGHAMITRA MANNA	GENERAL
04.	PHDEIEE17001283	MAYANK KUMAR GAUTAM	GENERAL
05.	PHDEIEE17001272	DEBANJAN BAKSHI	GENERAL
06.	PHDEIEE17001545	DEVI P KRISHNAN	GENERAL
07.	PHDEIEE17001475	SHREYA NAG	GENERAL
08.	PHDEIEE17001731	BIJOY BHOWMIK	GENERAL

MECHANICAL ENGINEERING DEPARTMENT

Department of Mechanical Engineering

LIST OF CANDIDATES TO APPEAR IN WRITTEN TEST

Sl No On Hard Copy form	Appl_No	Name	Category
5	PHDEMEC17000939	SALMAN HOSSAIN	General
8	PHDEMEC17001058	ARCHISMAN DASGUPTA	General
9	PHDEMEC17001531	SHATRUDHAN PANDEY	General
10	PHDEMEC17001867	AVISHEK SAMANTA	General
12	PHDEMEC17001232	ANUPAM KUNDU	General
18	PHDEMEC17001492	MD SHAMIM RAZA	General
19	PHDEMEC17001252	SYED MUJIBUR RAHMAN	QIP
21	PHDEMEC17001709	SHIBA PARASAD NATH BHOWMIK	OBC - B (NCL)
25	PHDEMEC17001879	ARKAPRABHA BHATTACHARJEE	General
28	PHDEMEC17001275	MOUMITA TEWARY	General
29	PHDEMEC17001313	PUJA GHOSAL	General

31	PHDEMEC17001716	ARNAB RAY	General
40	PHDEMEC17001354	SUDIPTA SWAIN	General
41	PHDEMEC17001323	PUSPENDU CHANDRA CHANDRA	General
42	PHDEMEC17001317	SABYASACHI MUKHERJEE	General
45	PHDEMEC17001336	ABHIJIT DEBBARMA	Scheduled Tribe
46	PHDEMEC17001327	SAYON DEY	OBC - B
50	PHDEMEC17001440	ABIDA SULTANA	General
52	PHDEMEC17001410	BIDHAN CHANDRA DAS	General
55	PHDEMEC17001532	KANNARASU VEMBU	General
56	PHDEMEC17001468	SUBHRAJYOTI SARKAR	General
57	PHDEMEC17001367	SUBHADIP DAS	Scheduled Caste
59	PHDEMEC17001503	IVY CHOWDHURY	General
61	PHDEMEC17001391	ABHINANDAN BARUAH	General
62	PHDEMEC17001386	MILAN KUMAR MOTTA	General
63	PHDEMEC17001706	JOYDIP RAY	General
64	PHDEMEC17001530	SARAVANAN S	General
67	PHDEMEC17001533	HARIHARAN S	General
70	PHDEMEC17001428	RANOJIT BANERJEE	General
71	PHDEMEC17001638	SOURAV SARKAR	General
73	PHDEMEC17001617	SOUMOJIT DASGUPTA	General
74	PHDEMEC17001471	SUBHADIP RAY	OBC - B (NCL)
78	PHDEMEC17001707	ASHIM KUMAR SAHA	General
79	PHDEMEC17001556	RAJARSHI CHAKRABORTY	General
80	PHDEMEC17001591	ASHIQUE ELLAHI	General
82	PHDEMEC17001928	RAJIB GUPTA	General
84	PHDEMEC17001609	ANUSTUP CHATTERJEE	General
85	PHDEMEC17001911	SANCHARI GHOSH	General

86	PHDEMEC17001708	TARAK NATH CHELL	SC
88	PHDEMEC17001602	DEBANJAN MUKHERJEE	General
92	PHDEMEC17001950	UJJAL SAHU	General
94	PHDEMEC17001637	RAVI KUMAR	General
95	PHDEMEC17001626	ANTARIPA BHUYAN	General
97	PHDEMEC17001636	SMITA PANDEY	General
98	PHDEMEC17001660	SUBRATA BISWAS	OBC - B
99	PHDEMEC17001694	SOUMYA MUKHERJEE	General
104	PHDEMEC17001711	NILAY MANDAL	General
106	PHDEMEC17001747	DIPANJAN SAREN	Scheduled Tribe
108	PHDEMEC17001759	SOURAV SAHA	General
109	PHDEMEC17001824	HIRANMOY SAMANTA	General
111	PHDEMEC17001739	THIA PAUL	OBC - B
112	PHDEMEC17001852	POOJA SARKAR	General
115	PHDEMEC17001775	RABI SHANKAR SINGH	General
119	PHDEMEC17001841	ANKESH SAMANTA	General
124	PHDEMEC17001948	PRATEEK DAS	General
125	PHDEMEC17001869	ABIRA GUHA	General
126	PHDEMEC17001868	KAUSICK BASU	General
127	PHDEMEC17001900	RANJAN KUMAR	General
130	PHDEMEC17001886	KOUSTOV MONDOL	Scheduled Caste
133	PHDEMEC17001944	SOUVICK CHAKRABORTY	General
134	PHDEMEC17001998	SUTANU MISRA	General
136	PHDEMEC17002034	RAJARSHI MONDAL	OBC - B (NCL)
139	PHDEMEC17001992	DEBAYAN MONDAL	Scheduled Caste
144	PHDEMEC17001657	SAYANTAN DATTA	General

For the following candidates, no hard copy form has been received. Candidates should appear in written test along with hardcopy application form with enclosures.

Sl No On Hard Copy form	Appl_No	Name	Category
No Form Recd.	PHDEMEC17000136	RANOJIT BANERJEE	General
No Form Recd.	PHDEMEC17001070	RAKTIM DASGUPTA	General
No Form Recd.	PHDEMEC17001298	PRIYABRATA PUHAN	General
No Form Recd.	PHDEMEC17001802	SOUMYODEEP MUKHERJEE	General
No Form Recd.	PHDEMEC17001723	MANAS ROY	General
No Form Recd.	PHDEMEC17002030	ZIYAUDDIN SEIKH	OBC - A
No Form Recd.	PHDEMEC17001865	CHITRAK DUTTA	General

METALLURGICAL & MATERIAL ENGINEERING DEPARTMENT

Sl. No.	Application No.	Name	Category
1	PHDEMET17001088	SURAJIT PATRA	General
2	PHDEMET17001444	SOUAMYABRATA BASAK	General
3	PHDEMET17001674	TISHTA DAS	General
4	PHDEMET17001861	AKRITY ANAND	General
5	PHDEMET17001322	PUSPENDU CHANDRA CHANDRA	General
6	PHDEMET17001316	SABYASACHI MUKHERJEE	General
7	PHDEMET17001612	SUMAN KHAN	General
8	PHDEMET17001678	KALIPADA DAS	SC
9	PHDEMET17001635	SMITA PANDEY	General
10	PHDEMET17001959	UNISSA NICHUL	General
11	PHDEMET17001757	SOURAV SAHA	General
12	PHDEMET17001929	ARCHISMAN DASGUPTA	General

PHARMACEUTICAL TECHNOLOGY DEPARTMENT

Sl. No.	Application No.	Name	Category
1.	PHDEPHA17002019	BIDISHA DEY	GENERAL
2.	PHDEPHA17001553	DISHARI DUTTA	GENERAL
3.	PHDEPHA17001464	SUJIT DAS	OBC-B
4.	PHDEPHA17001527	SIDDHESWAR MAITI	GENERAL
5.	PHDEPHA17001953	RAMKRISHNA SEN	GENERAL
6.	PHDEPHA17001493	APALA CHAKRABORTY	GENERAL

POWER ENGINEERING DEPARTMENT

Sl No.	Application No.	Name	Category
1	PHDEPOW17001792	ANGSHUMAN ROY	SC
2	PHDEPOW17001238	DEBAYAN BASU	GN
3	PHDEPOW17001631	SUBHASHREE PRUSTY	GN
4	PHDEPOW17001515	MAYURAKSHI MONDAL	GN
5	PHDEPOW17001321	PUSPENDU CHANDRA CHANDRA	GN
6	PHDEPOW17001315	SABYASACHI MUKHERJEE	GN
7	PHDEPOW17001435	AYANTANI BHATTACHARJEE	GN
8	PHDEPOW17001628	SHIBAJI MONDAL	GN
9	PHDEPOW17001684	AMITAVA DUTTA	GN

10	PHDEPOW17001732	AMIT DEBNATH	GN
11	PHDEPOW17001884	SRIJA MUSTAFI	SC

PRINTING ENGINEERING DEPARTMENT

Sl. No.	Application No.	Name	Category
1.	PHDEPRN17001287	JAYEETA SAHA	GEN
2.	PHDEPRN17001243	SAORABH KUMAR MONDAL	SC
3.	PHDEPRN17001389	GUNJAN MUKHERJEE	GEN
4.	PHDEPRN17001720	SANJAY BHARTI	GEN

PRODUCTION ENGINEERING DEPARTMENT

Sl. No.	Application No.	Name	Category
1	PHDEPRD17001053	ARCHISMAN DASGUPTA	General
2	PHDEPRD17000982	SANDIP KUMAR CHAUDHURY	General
3	PHDEPRD17001231	ANUPAM KUNDU	General
4	PHDEPRD17001312	PUJA GHOSAL	General
5	PHDEPRD17001314	SABYASACHI MUKHERJEE	General
6	PHDEPRD17001320	PUSPENDU CHANDRA CHANDRA	General
7	PHDEPRD17001409	BIDHAN CHANDRA DAS	General
8	PHDEPRD17001441	ABIDA SULTANA	General
9	PHDEPRD17001469	SUBHADIP RAY	OBC - B (NCL)
10	PHDEPRD17001514	BISWAJIT PAUL	General
11	PHDEPRD17001597	SUPRAKASH MONDAL	General
12	PHDEPRD17001606	DEBANJAN MUKHERJEE	General
13	PHDEPRD17001639	PEERAJ MAZUMDER	General
14	PHDEPRD17001647	SANDIP PALIT	General
15	PHDEPRD17001738	THIA PAUL	OBC - B
16	PHDEPRD17001741	AKHTARUJJAMAN SARKAR	OBC - B
17	PHDEPRD17001758	SOURAV SAHA	General

18	PHDEPRD17001816	IVY CHOWDHURY	General
19	PHDEPRD17001878	ARKAPRABHA BHATTACHARJEE	General
20	PHDEPRD17001994	DEBAYAN MONDAL	Scheduled Caste
21	PHDEPRD17002033	RAJARSHI MONDAL	OBC - B (NCL)
22	PHDEPRD17002038	DHRUBAJYOTI CHAKRABORTY	General

ANNEXURE: SYLLABUS FOR WRITTEN ENTRANCE EXAMINATION TO Ph.D. PROGRAMME FOR EACH COURSE

ARCHITECTURE DEPARTMENT

Part I - Research Methodology

- Types of Research
- Research Method vs. Research Methodology
- Criteria of Good Research
- Basic Statistics - Sampling, Distribution, Normality, Probability, Mean-Median-Mode, Correlation, Regression, Variance, Co-variance
- Data representation - Tables, Graphs, Charts
- Research Ethics
- Research Thinking and Research Design
- Research Writing – Proposals and Final Report
- Data collection of qualitative/subjective research – such as interview, survey, etc.
- Analysis and interpretation of qualitative/subjective research.

Part 2- Subjects in Architecture and Allied Engineering

• **Architecture and Structures**

- Wood, Steel, RCC & other building materials; High rise & long span structures; Gravity & Lateral Load; Disaster resilient structures.

• **Architecture and Services**

- Illumination and Acoustics
- Electrical systems - Supply, Transformer, Wiring, AC
- Electro-Mechanical systems - HVAC, Pumps, Lift
- Environmental Engineering - Water Supply, Drainage, Sewerage Systems, Plumbing, Solid Waste Management

• **Architecture as System and Design**

- Architectural Theory: Sociological, Cultural, Anthropological, Demographical, Formal and Others
- History and Contemporary Architecture
- Materials and Methods of Architectural Construction
- Ecology & Environment - Climatology, Pollution, Environmental considerations in design
- Estimation, Costing, Specification, Project Management, Professional Practice
- Architectural Standards, Anthropometrics,
- Graphics, 2D-3D Forms, Geometry and Construction
- Computer Graphics – CAD, BIM, 3D modeling and Architectural rendition
- Architectural Design, Building Types, Circulation, Site Planning
- Architecture and building regulations, codes, relevant legislative frameworks

• **Architecture and Specializations**

- Planning - Regional, Urban, Environmental, Transport, Housing
- Urban Design
- Architectural Conservation

- Landscape Architecture
- Interior Design
- Industrial Design
- Sustainability, Sustainable Architecture & Design – Resource efficiency in buildings, Green Building, Energy Efficiency
- Building Science

CHEMICAL ENGINEERING DEPARTMENT

Part 1: Research Methodology

Mathematics; Matrices, Algebraic equations, Ordinary Differential equations, Partial differential equations, Laplace transformation;
Statistical Methods: Regression, Error analysis;
Numerical Methods for solving Linear and nonlinear algebraic equations, ODEs, IVP and BVP, Partial differential equations;
Design of experiment.

Part 2 : Subjects in Chemical Engineering

As per normal Chemical Engineering curriculum/syllabus as available at Jadavpur University website www.jaduniv.edu.in

CIVIL ENGINEERING DEPARTMENT

Students should answer all questions from Part 1: Research Methodology and 25 questions out of 150 MCQs from Part 2. If more than 25 questions are answered from Part 2, only first

Part 1. Research Methodology

1. Meaning of research, dissertation, thesis, Term paper, journal paper, concept notes.
2. Research hypothesis, need and justification, Novelty of Research.
3. Characteristics and components of Research, Need based /specific problem solving (state / national)
4. Topics identification, learning, formulating and analyzing the problem with existing problem/project/extension work of respective department / division / interdepartmental efforts.
5. Search Procedures for statement and formulation of research problem.

Literature survey, web search, textual reading, search engine application, online data search , use of internet, personal communication, bound journal/paid journal/ E-journals, institution repository, gateway, cross-ref, Scopus, Science Direct, Advanced search tools. Institution Library consultation/ borrow

6. Application of proposed research / Fundamental Research/ Experiment base Numerical/ Computation.
7. Computation work, language, programming, software tools, to be used. Spread sheet, features and functions, data storage, generating charts, graphs tables- use of latest's software tools, features of statistical tools/ features
8. Application of theoretical and system modeling for respective area of problems.
9. Statistical tools with data mining. Probability and sampling distribution, ANOVA test, knowledge on statistical package, correlations, Test of Hypothesis, Student test, error analysis, mean square error , Box analysis, normalization of data series, Linear programming, Dynamic Programming , Fuzzy logic problem.

10. Optimization analysis:-

Use of Factors, ANN, ANOVA (BOTH WAYS), SIGNAL TO NOISE RATIO, Orthogonal arrays, replication, Data validation with predicted values

11. Aims and objective of research.

Area of Research- Formulation of research objectives based on Literature survey, critical review, Gaps exist in present knowledge domains in the field of research, Scope analysis

12. Research Approach:- Study population, parameters estimation and consideration, sampling-field / industrial real life, monitoring, Experimental investigation, Literature /Proceedings/ journal search, etc. Plan for data collection, and analyzing, Plan For data processing and recording , Ethical presentation

13. Experimental Work: - Analytical methods/ Protocols, Standard methods national and international codes, flowchart for Experimental procedures, Fabrication details of experimental devices and instruments to be used, experimental Set up, pilot plant if any to be required. Replications, Quality control, Quality Assurance procedures, Standardization of instruments to be used.

14. Work plan: - Major components and outline of the different phases of research investigation, use of flow chart, time frame summary of proposal.

15. Use of mathematical tools:- Numerical analysis, Finite element and difference , differential equation solving tools, use of tensor and vector calculus, etc.,design of experiment.

16. Presentation tools:- Power point tool, creating and customizing presentation.

17. Thesis writings: - Draft thesis, paper communication and publications, conference attendance presentation proceedings , Plagiarism checking (use of Urkund,Biblio,Tertitin) and citation. Major contribution, outcome of the research, patent possibilities.

Part 2: Subjects in Civil Engineering

1. Structural Engineering

Structural Analysis

Bending moment and Shear force for determinate and indeterminate structures, Bending stress, Shear stress, Shear flow and shear centre, Torsion of circular shafts, Analysis of two and Three hinged Arch

Strain energy principle: Castiglino's theorems, Deflection analysis of beams, frames and trusses,Slope and deflection analysis of beams.Influence line analysis for determinate beams, trusses and three hinged arches.

Buckling load: Euler's theory, Rankine's theory, empirical formulae, Column under eccentric load, Beam–Column. Buckling analysis by energy principle, Unsymmetrical bending, Slope-Deflection method and Moment distribution method. Beams and Portal frame problems. Two hinged and fixed Arches. Beams Curved in plan. Approximate analysis of Multi bay Multistoried Portal frames: Cantilever method, Portal method.

Stiffness and flexibility methods: Matrix methods of structural analysis. Analysis of Suspension bridges, Influence linediagram for Three hinged and Two-hinged stiffening girders. Influence line diagram for indeterminate structures: Muller-Breslau principle. Plastic analysis of Structures: Beams and Portal frames. Model analysis and applications.

Theory of plate bending: Navier's solution, Levy's solution. Plate buckling problems.

Concrete Technology

Cement-manufacturing process.Physical and Chemical properties. Different types of cement and their uses. Codes of practices, Testing of cement: Physical and Chemical tests. Tests on fresh and hardened concrete.Chemical admixtures and Plasticizers.Durability of concrete. Mix design approaches. High Performance Concrete, Ready Mixed Concrete. Fibre Reinforced Concrete.Shotcrete .Pumped concrete.Fly ash concrete. Self -Compacting concrete. Polymer concrete,etc. Grouting and grouting materials.

Concrete Design

Properties of concrete. Codes of practices. Working stress and limit state design of reinforced concrete structures: Single and Doubly reinforced rectangular, T, L, sections etc. against bending moment, shear forces and Torsion.

Bond stress: Development length and Lap length. Design of One-way and Two-way Slabs. Staircase. Continuous beams. Axially loading columns. RCC members under combined bending and axial load. Isolated footing.

Design of Multistoried RCC buildings considering wind and seismic forces. IS code and specification, Combined and Strip footing. Raft foundation. Pile foundations. Retaining walls. Underground water tanks. Overhead water tank. RCC Culverts and bridges: IRC loading, design of deck slab and girder. Design of Prestressed concrete structures

Steel Design

Design of Riveted, Bolted and Welded joints and connections. Working stress and limit state design of Tension and Compression members, Beams and Plated beams, Roof trusses, Purlins, Columns, Base connection and foundations. Compound columns with lacing and battens. Design of Steel structures using tubular, rectangular and square section. Gantry girders and Gantry columns including base and foundation. Steel Portal frames. Pressed steel water tanks rectangular and circular tanks. Steel Towers

Dynamic Analysis

Free and forced vibration analysis, Damped and Undamped vibration analysis of Single and Multiple degree of freedom systems: Beams and Portal frames. Plate vibration. Vibration control. Machine foundation. Random vibration.

Theory of Elasticity and Elastic Stability

2 and 3-dimensional stress tensors, equations of equilibrium and compatibility, plane stress and plane strain problems, stress functions, constitutive relationship. Equations in Cartesian and Polar coordinates systems, bending of beams and plates, torsion of shafts, Introduction to bifurcation of equilibrium, beam-column, plates under axial compression, Finite element formulation of geometrically non-linear problem.

Finite element method

Matrix Algebra – methods for matrix inversion and solution of simultaneous equations – band and sparse matrix techniques – stiffness and flexibility matrices of structural elements – various coordinate system and their transformation and synthesis – matrix formulation of force and displacement methods – member approach. Finite element concept in Engineering Analysis – Displacement model shape functions and element properties. Analysis of plane stress/strain – axis-symmetric stress analysis. Weighted residual methods and variational formulation of Finite Element Analysis. Isoparametric element – Potential flow and heat transfer in 2-Dimension – Numerical integration.

2. Soil Mechanics & Foundation Engineering

Formation and types of soil, Weight and volume relationships; consistency limits, particle size distribution; identification and classification of soil; soil structure and clay mineralogy. Soil water suction and capillary rise, effective and pore water pressure. Permeability and ground water flow – Darcy's law, factors affecting permeability; laboratory and field determination of permeability,

permeability of stratified deposits. Seepage pressure; quick condition; Laplace's equation; construction and use of flow nets, piping and heaving. Compaction of soil– compaction phenomena, laboratory compaction test and field compaction control. Compressibility and consolidation of soil– Terzaghi's theory of one-dimensional consolidation; consolidation test and evaluation of consolidation parameters. Three dimensional consolidation; Numerical solution, uniform and layered deposits. Sand drains – theory and applications.

Shear strength of soil, Mohr-Coulomb theory, Determination of shear strength from laboratory and field tests. Stress path and its application.

Stability of earth slopes, finite and infinite slopes, stability analysis by Swedish method of slices; stability number; tension cracks. Stability of Dams under steady seepage and rapid drawdown conditions. Lateral earth pressure; earth pressure at rest, active and passive conditions; Rankine and Coulomb's theory; Earth pressure on retaining walls. Bearing capacity of soil; modes of failure; bearing capacity theories; factors affecting bearing capacity. Subsurface exploration, methods of boring and sampling; different types of samplers; ground water observations.

Stress distribution in homogeneous, non-homogeneous, layered and anisotropic deposits; Effect of nonlinearity

Design of shallow foundation with settlement analysis in Sand and Clay,

Principles of ground improvement; Mechanical densification; Drop hammer and compaction pile; Compaction of cohesive soils, pre-loading and vertical drains, stone columns and granular piles; Admixture stabilisation; Grouting; Geotextile application.

Pile foundations – vertical and lateral loads; Settlement of Piles; Negative skin friction of piles; Uplift capacity of piles and anchors; Foundations on expansive soils; Well foundations; Machine foundations.

Cantilever sheet pile wall; Anchored bulk head, Free and fixed earth support methods, types of sheet piles and construction aspects; cellular coffer dams, design procedures, interlock, piling rise and overturning; Braced excavation, types, earth pressure, effect of wall rigidity and sequence of construction, Design of wall and wall supports; tunnels and shafts, pressure distribution, design of tunnel lining, methods of tunnelling, ground loss.

3. Environmental Engineering

Section A :- Air pollution and control

Criteria and non criteria air pollutants, effect of air pollution, measurement of air pollutants (PM_{10} , PM_5 , $PM_{2.5}$, NO_x , SO_2), Air quality Index (AQI), Standards and limits, Air pollution monitoring, Source apportioning model, receptor model, plume dispersion model, plume pattern and atmospheric stability, stack monitoring, Box model, Canyon modeling, Caline model, Street dispersion one dimensional highway model, fundamental of air pollution control devices (SPM Control only), Green House effect, Acid rain, Global Warming, Ozone layer depletion, Emission standard.

Section B :- Water Supply & Treatment

Water Demand, Water sources- surface and ground water, quality of drinking water, Water Quality Index (WQI), Delphi Techniques, Bacteriological examination of water, Water distribution system and network analysis, Balancing reservoir,

Water treatment methods- Various unit operations, Flow diagram, settling analysis, High rate settling theory, Colloid dispersion double layer ionic theory, Coagulation and Flocculation, Jar test, Filtration process, Adsorption process, disinfection Break point chlorination, softening process, Drinking water quality standard, Fluoride and arsenic remediation techniques.

Section C: - Solid Waste Management

Classification of Solid Waste, Characteristics, Sampling and analysis, Integrated Solid waste Management Practice, Collection Methods, (Manual and contain) transfer station, processing and disposal methods, Incineration and pyrolysis, landfill, leachate estimation, HELP model, energy content evaluation, landfill liner system and design, route selection and optimization, composting and vermiculture , aerobic and anaerobic digestion of solid waste, waste to energy, Hazardous and biomedical waste and their management, Solid waste Management Rules.

Section D: - Wastewater Engineering

Waste water characteristics, BOD, COD and their determination, Storm drainage system, rational methods, sanitary sewer and combine sewer design, basic microbiology and kinetics of bacteriological growth.

Primary treatment of sewage- Screen, Grit chamber, oil & grease removal, primary clarifier, chemical sedimentation, pH Control.

Secondary Treatment- Biological treatment of wastewater, Suspended growth and fixed film reactor system, Activate sludge process, Trickling filter, Bio filter, Aerated lagoon, extended aeration process, stabilization pond, hybrid bioreactor, SBR, Anaerobic digester.

Tertiary Treatment- Advanced oxidation, Electro coagulation, Adsorption, Reverse Osmosis, Reuse and treated wastewater.

Mathematical Modeling of Wastewater treatment system-ASPM I , Atkinson, hybrid, material balance, Rittman, McCarty, Davis , Isotherm, Reaction Order, Break through column (BDST), etc

Sludge handling and treatment, heavy metal removal process, chemical oxidation, equalization, neutralization.

Section E: - Environmental Management

Rudiments of EIA, Scoping criteria and analysis, EIA methodology, Matrix , Leopold, Tally methods, short term and long term (Rapid and final EIA), EMP, Rules and regulations, category of EIA on industrial basis, Pollution control requirements.

---Noise pollution, sound pressure level, units, standards, Noise meter, Noise pollution control.

--- Ecology & Environment-Aquatic ecosystem , ecosystem, components population ecology, Solar energy and its importance, productivity, food chain, Trophic level, Ecological pyramid, bio geochemical cycles

- Plant Physiological Stress, POD, NRA, oxidative stress, phytoremediation, Plant Enzymes features.
- Environmental Monitoring system- sustainable development
- Green Technology, carbon credit, green building concept.

4. Water Resources Engineering

1) Hydrological Cycle:- Rainfall runoff measurement technique devices, Aquifer, Aquifer Parameters, Darcy's Law, Steady & Unsteady State Well Hydraulics, Ground Water Flow, Salt water intrusions Stream flow measurement technique , Infiltration Indices , ϕ and W Index, Hydrograph analysis, Unit hydrograph, S and Instantaneous hydrograph , Synthetic hydrograph, Flood estimation, Abstraction of precipitation, flood routing.

2) Statistical; hydrology----Rainfall Analysis, RI R period , uncertainties, R Index, Mean Value Problem, Monte Carlo Simulation, Parameter Estimation, Moment Method, Likelihood Method, Goodness of fit Kolmogorov test, χ^2 analysis , Anderson test

3) Hydrologic simulation model. Watershed model- HEC, HSPF (Standard Package Further), SWM, MIKE. Watershed classifications. Simulation model, forecasting models Deterministic, Stochastic, Muskingum model. Multi objective modeling, Optimization model. Use of Fuzzy Logic for Optimisation.

4) Water Resource Engineering :-Hydroelectric power plant, Dam hydrology, Diversion work, Weirs and barrage, Spur, Scour depth, lined and unlined canals , canal irrigation system, hydraulic structures, apron, falls, hydraulic jumps, siphon, aqueduct. Concepts of Isovels, Draught and flood management , Remote sensing and GIS, GPS applications, River training and Bank protection, Gates and Valves for flow control, spillways and energy dissipaters, Stage –Discharge curve.

5. Remote Sensing & GIS

Energy sources, energy interaction in the atmosphere, data acquisition and interpretation, types of scanning and sensing system, History of Indian Remote Sensing, Types of data, Visual Image interpretation, Concept of GPS and its application, Digital Image Analysis - rectification and restoration, Image enhancement, manipulation techniques, Image classification, Post classification Smoothing, classification accuracy assessment, Principles of GIS, Application of Remote Sensing and GIS in different projects.

6. Transportation Engineering

Mathematics:

Fundamentals of Statistics:

Collection and graphical representation of data; Measures of central tendency and measures of dispersion; Correlation and regression; Linear regression, Introduction to non-linear regression; Sampling theory; Hypothesis testing; Confidence interval; Probable errors; Analysis of variance Theories of Probability:

Random experiments and events; Classification of probability; Laws of probability; Definition and postulates of probability; Field of probability; Mutually exclusive events; Bayes' Theorem; Independence; Bernoulli trial; Conditional probability distribution; Binomial, Normal and Poisson distributions;

Optimisation Technique:

Calculus of several variables; Implicit function theorem; Nature of singular points; Necessary and sufficient conditions for optimization; Elements of calculus of variation; Constrained Optimisation; Lagrange multipliers; Gradient method; Dynamic programming

Highway Engineering:

Traffic studies:

Speed, volume, delay and capacity of highways; Origin and destination studies; parking studies; accident surveys; Traffic forecasting; Traffic flow characteristics; Capacity and Level of service at basic freeway segments and highway intersections; Traffic Controls and signals

Theory of traffic flow including shock waves, bottlenecks and weaving; Queuing theory and its application; Management of signalised and unsignalised intersections

Trip Generation, Distribution, Modal split and Traffic Assignment; Land use transport models; Transportation economics; urban transportation management

Geometric design of highway:

Cross Sectional elements, Curves: Horizontal and Vertical, Intersection Geometry, conflicts and Grade separation, Road drainage; Illumination

Pavement and Its Design:

Types; Components; Wheel loads; Stresses in flexible pavements – Two layer system; Flexible pavement design – Burmister Method, IRC Method, AASHTO methods and mechanistic approach; Stresses in rigid pavements; Rigid Pavement Design by Westergaard, and IRC method.

Pavement Material and Construction:

Highway Materials and Testing under static and repetitive loading; Construction of flexible pavement.

Pavement evaluation, maintenance and management:

Pavement failures; quality control and Assessment; Overlay design of flexible and rigid pavement

Railway Engineering:

Elements of permanent way; Tractive resistance's; gradients and grade compensation on curves; cant; transition curves; vertical curves; Stresses in railway tracks; Points and crossings; Signalling and interlocking, Maintenance of railway track.

Airport Engineering:

Planning and layout; runway and taxiway; grading and drainage; Design of Pavement

COMPUTER SCIENCE & ENGINEERING DEPARTMENT

Part 1: Research Methodology

Part-A:

30 Marks

Research methodology objectives; distinct approaches - descriptive, analytical, quantitative, qualitative, applied vs fundamental research; Research processes.

Different ways of benchmarking performance.

Mathematical Theory of Probability: Basic concepts, Classical and axiomatic approaches, Sample space and events, Properties of probability functions.

Conditional probability and independent events, Concept of random variable, Discrete and continuous probability density, mass and distribution functions.

Expectations and moments, Moment generating and characteristic functions, binomial and normal distributions.

Suggested Readings:

- "Research Methodology: Methods and Techniques" by C. R. Kothari
- Higher Engineering Mathematics by B.S Grewal, Khanna Publishers, 42nd Edition.
- Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Academic Press, 4th Edition.
- A Modern Introduction to Probability and Statistics- Understanding Why and How by F.M. Dekking, C. Kraaikamp, H. P. Looij, L.E. Meester, Springer Publisher.

Part-B:

20 Marks

Writing as per conventions showing control of grammar, spelling, word usage, syntax, and punctuation; use of appropriate tone, style, and diction; uses appropriate formatting, media, design, and documentation of sources.

Useful moves for entering into and maintaining professional relationships through writing, which include writing memorandums, formal letters, application letters, cover letters and resumes.

Technical Communication Strategies and Researched Report Writing including origin of writing, scientific article writing, preparation of a short summary, writing introduction and/or conclusion for a given text.

International English Style; Principles of Simplicity, Clarity, Correspondence and Cultural Adaptation.

Suggested Readings:

- [Technical Communication](#) by Markel, Mike, 10th Edition Boston: Bedford/St. Martin's, 2010.
- The Chicago Guide to Communicating Science: Second Edition by [Scott L. Montgomery](#), University of Chicago Press.
- Anderson, Paul V. (2011). Technical Communication: A ReaderCentered Approach. 7th ed. Wadsworth: Boston.
- How To Write and Publish a Scientific Paper, Robert A. Day Fifth Edition, Oryx Press, Phoenix, AZ, 1998.
- The Elements of International English Style: A Guide to Writing Correspondence, Reports, Technical Documents, and Internet Pages for a Global Audience by [Edmond H. Weiss](#), 1st Edition, M.E. Sharpe, Inc.

Part 2: Subjects in Comp. Sc. and Engg.

Module 1 is compulsory (carrying 20 marks)

- Module 1
- Programming in C.*
 - Data Structure:* Array, Stack, Queue, Linked list, Tree, Binary Tree, Binary search tree.

One can attempt any three modules from the following (each module carrying 10 marks)

- Module 2
- Basic Electronics and Circuit Theory:* Diode, Bipolar junction transistor, FET, Amplifier circuits, Kirchhoff's law, Thevenin's Theorem, Norton's Theorem, RC, LR, LCR circuits.
 - Digital Logic:* Logic gates, Combinational circuits (Decoder, Encoder, Multiplexer), Minimization, Flip-Flops, Counters.
- Module 3
- Mathematics:* Functions, First order derivative, Set theory, Permutation and Combination.
 - Numerical methods:* Solution of non-linear equation, Solution of linear simultaneous equations.
- Module 4
- Microprocessor (8085):* Instruction set and addressing modes, ALU, Data-path, and Control unit.
 - Computer organization:* Memory Organization, ALU Design, Control Unit Design (Micro-programmed and Hardwired control units), Interrupt handling.
- Module 5
- Data Communication and Network:* OSI model, Modulation and Encoding, Flow control, Error control at Data Link Layer, IP addressing & subnet masking, Routing algorithms (Link State and Distance Vector algorithms).
- Module 6
- Operating System:* Memory management (Paging, Segmentation, Virtual memory management), Process management (PCB, Scheduling algorithms such as FCFS, RR), Inter Process Communication (PIPE-FIFO, Semaphore, Shared memory).
- Module 7
- DBMS:* E-R Diagram, Relational model, Functional dependency and Normalization.
- Module 8
- Formal Language and Automata:* DFA, NFA, Regular expression, Context-free grammar and Pushdown automata
 - Compiler:* LL parsing, Intermediate code generation.

CONSTRUCTION ENGINEERING DEPARTMENT

Students should answer all questions from Part 1: Research Methodology and 25 questions out of 150 MCQs from Part 2. If more than 25 questions are answered from Part 2, only first

Part 1. Research Methodology

1. Meaning of research, dissertation, thesis, Term paper, journal paper, concept notes.
2. Research hypothesis, need and justification, Novelty of Research.

3. Characteristics and components of Research, Need based /specific problem solving (state / national)

4. Topics identification, learning, formulating and analyzing the problem with existing problem/project/extension work of respective department / division / interdepartmental efforts.

5. Search Procedures for statement and formulation of research problem.

Literature survey, web search, textual reading, search engine application, online data search , use of internet, personal communication, bound journal/paid journal/ E-journals, institution repository, gateway, cross-ref,Scopus, Science Direct, Advanced search tools. Institution Library consultation/ borrow

6. Application of proposed research / Fundamental Research/ Experiment base Numerical/ Computation.

7. Computation work, language, programming, software tools, to be used. Spread sheet, features and functions, data storage, generating charts, graphs tables- use of latest's software tools, features of statistical tools/ features

8. Application of theoretical and system modeling for respective area of problems.

9. Statistical tools with data mining. Probability and sampling distribution, ANOVA test, knowledge on statistical package, correlations, Test of Hypothesis, Student test, error analysis, mean square error , Box analysis, normalization of data series, Linear programming, Dynamic Programming , Fuzzy logic problem.

10. Optimization analysis:-

Use of Factors, ANN, ANOVA (BOTH WAYS), SIGNAL TO NOISE RATIO, Orthogonal arrays, replication, Data validation with predicted values

11. Aims and objective of research.

Area of Research- Formulation of research objectives based on Literature survey, critical review, Gaps exist in present knowledge domains in the field of research, Scope analysis

12. Research Approach:- Study population, parameters estimation and consideration, sampling-field / industrial real life, monitoring, Experimental investigation, Literature /Proceedings/ journal search,etc.Plan for data collection, and analyzing, Plan For data processing and recording , Ethical presentation

13. Experimental Work: - Analytical methods/ Protocols, Standard methods national and international codes, flowchart for Experimental procedures, Fabrication details of experimental devices and instruments to be used, experimental Set up, pilot plant if any to be required. Replications, Quality control, Quality Assurance procedures, Standardization of instruments to be used.

14. Work plan: - Major components and outline of the different phases of research investigation, use of flow chart, time frame summary of proposal.

15. Use of mathematical tools:- Numerical analysis, Finite element and difference , differential equation solving tools, use of tensor and vector calculus, etc.,design of experiment.

16. Presentation tools:- Power point tool, creating and customizing presentation.

17. Thesis writings: - Draft thesis, paper communication and publications, conference attendance presentation proceedings , Plagiarism checking (use of Urkund,Biblio,Tertitin) and citation. Major contribution, outcome of the research, patent possibilities.

Part 2: Subjects in Construction Engineering

1. Structural Engineering

Structural Analysis

Bending moment and Shear force for determinate and indeterminate structures, Bending stress, Shear stress, Shear flow and shear centre, Torsion of circular shafts, Analysis of two and Three hinged Arch

Strain energy principle: Castiglino's theorems, Deflection analysis of beams, frames and trusses, Slope and deflection analysis of beams. Influence line analysis for determinate beams, trusses and three hinged arches.

Buckling load: Euler's theory, Rankine's theory, empirical formulae, Column under eccentric load, Beam-Column. Buckling analysis by energy principle, Unsymmetrical bending, Slope-Deflection method and Moment distribution method. Beams and Portal frame problems. Two hinged and fixed Arches. Beams Curved in plan. Approximate analysis of Multi bay Multistoried Portal frames: Cantilever method, Portal method.

Stiffness and flexibility methods: Matrix methods of structural analysis. Analysis of Suspension bridges, Influence linediagram for Three-hinged and Two-hinged stiffening girders. Influence line diagram for indeterminate structures: Muller-Breslau principle. Plastic analysis of Structures: Beams and Portal frames. Model analysis and applications.

Concrete Technology

Cement-manufacturing process. Physical and Chemical properties. Different types of cement and their uses. Codes of practices, Testing of cement: Physical and Chemical tests. Tests on fresh and hardened concrete. Chemical admixtures and Plasticizers. Durability of concrete. Mix design approaches. High Performance Concrete, Ready Mixed Concrete. Fibre Reinforced Concrete. Shotcrete . Pumped concrete. Fly ash concrete. Self -Compacting concrete. Polymer concrete, etc. Grouting and grouting materials.

Concrete Design

Properties of concrete. Codes of practices. Working stress and limit state design of reinforced concrete structures: Single and Doubly reinforced rectangular, T, L, sections etc. against bending moment, shearforces and Torsion.

Bond stress: Development length and Lap length. Design of One-way and Two-way Slabs. Staircase. Continuous beams. Axially loading columns. RCC members under combined bending and axial load. Isolated footing.

Design of Multistoried RCC buildings considering wind and seismic forces. IS code and specification, Combined and Strip footing. Raft foundation. Pile foundations. Retaining walls.

Underground water tanks. Overhead water tank. RCC Culverts and bridges: IRC loading, design of deck slab and girder. Design of Prestressed concrete structures

Steel Design

Design of Riveted, Bolted and Welded joints and connections. Working stress and limit state design of Tension and Compression members, Beams and Plated beams, Roof trusses, Purlins, Columns, Base connection and foundations. Compound columns with lacing and battens. Design of Steel structures using tubular, rectangular and square section. Gantry girders and Gantry columns including base and foundation. Steel Portal frames. Pressed steel water tanks rectangular and circular tanks. Steel Towers

Dynamic Analysis

Free and forced vibration analysis, Damped and Undamped vibration analysis of Single and Multiple degree of freedom systems: Beams and Portal frames. Plate vibration. Vibration control. Machine foundation. Random vibration.

Finite element method

Matrix Algebra – methods for matrix inversion and solution of simultaneous equations – band and sparse matrix techniques-stiffness and flexibility matrices of structural elements – various coordinate system and their transformation and synthesis-matrix formulation of force and displacement methods – member approach. Finite element concept in Engineering Analysis – Displacement model shape functions and element properties. Analysis of plane stress/strain – axis-symmetric stress analysis. Weighted residual methods and variational formulation of Finite Element Analysis. Isoparametric element – Potential flow and heat transfer in 2-Dimension – Numerical integration.

Theory of Elasticity and Elastic Stability

2 and 3-dimensional stress tensors, equations of equilibrium and compatibility, plane stress and plane strain problems, stress functions, constitutive relationship. Equations in Cartesian and Polar coordinates systems, bending of beams and plates, torsion of shafts, Introduction to bifurcation of equilibrium, beam-column, plates under axial compression, Finite element formulation of geometrically non-linear problem.

2. Soil Mechanics & Foundation Engineering

Formation and types of soil, Weight and volume relationships; consistency limits, particle size distribution; identification and classification of soil; soil structure and clay mineralogy. Soil water suction and capillary rise, effective and pore water pressure. Permeability and ground water flow – Darcy's law, factors affecting permeability; laboratory and field determination of permeability, permeability of stratified deposits. Seepage pressure; quick condition; Laplace's equation; construction and use of flow nets, piping and heaving. Compaction of soil – compaction phenomena, laboratory compaction test and field compaction control. Compressibility and consolidation of soil – Terzaghi's theory of one-dimensional consolidation; consolidation test and evaluation of

consolidation parameters. Three dimensional consolidation; Numerical solution, uniform and layered deposits. Sand drains – theory and applications.

Shear strength of soil, Mohr-Coulomb theory, Determination of shear strength from laboratory and field tests. Stress path and its application.

Stability of earth slopes, finite and infinite slopes, stability analysis by Swedish method of slices; stability number; tension cracks. Stability of Dams under steady seepage and rapid drawdown conditions. Lateral earth pressure; earth pressure at rest, active and passive conditions; Rankine and coulomb's theory; Earth pressure on retaining walls. Bearing capacity of soil; modes of failure; bearing capacity theories; factors affecting bearing capacity. Subsurface exploration, methods of boring and sampling; different types of samplers; ground water observations.

Stress distribution in homogeneous, non-homogeneous, layered and anisotropic deposits; Effect of nonlinearity

Design of shallow foundation with settlement analysis in Sand and Clay,

Principles of ground improvement; Mechanical densification; Drop hammer and compaction pile; Compaction of cohesive soils, pre-loading and vertical drains, stone columns and granular piles; Admixture stabilization; Grouting; Geotextile application.

Pile foundations – vertical and lateral loads; Settlement of Piles; Negative skin friction of piles; Uplift capacity of piles and anchors; Foundations on expansive soils; Well foundations; Machine foundations.

Cantilever sheet pile wall; Anchored bulk head, Free and fixed earth support methods, types of sheet piles and construction aspects; cellular coffer dams, design procedures, interlock, piling rise and overturning; Braced excavation, types, earth pressure, effect of wall rigidity and sequence of construction, Design of wall and wall supports; tunnels and shafts, pressure distribution, design of tunnel lining, methods of tunnelling, ground loss.

3. Transportation Engineering

Highway Engineering:

Traffic studies:

Speed, volume, delay and capacity of highways; Origin and destination studies; parking studies; accident surveys; Traffic forecasting; Traffic flow characteristics; Capacity and Level of service at basic freeway segments and highway intersections; Traffic Controls and signals

Theory of traffic flow including shock waves, bottlenecks and weaving; Queuing theory and its application; Management of signalised and unsignalised intersections

Trip Generation, Distribution, Modal split and Traffic Assignment; Land use transport models; Transportation economics; urban transportation management

Geometric design of highway:

Cross Sectional elements, Curves: Horizontal and Vertical, Intersection Geometry, conflicts and Grade separation, Road drainage; Illumination

Pavement and Its Design:

Types; Components; Wheel loads; Stresses in flexible pavements – Two layer system; Flexible pavement design – Burmister Method, IRC Method, AASHTO methods and mechanistic approach; Stresses in rigid pavements; Rigid Pavement Design by Westergaard, and IRC method.

Pavement Material and Construction:

Highway Materials and Testing under static and repetitive loading; Construction of flexible pavement.

Pavement evaluation, maintenance and management:

Pavement failures; quality control and Assessment; Overlay design of flexible and rigid pavement, condition monitoring of pavements

Railway Engineering:

Elements of permanent way; Tractive resistance's; gradients and grade compensation on curves; cant; transition curves; vertical curves; Stresses in railway tracks; Points and crossings; Signalling and interlocking, Maintenance of railway track.

Airport Engineering:

Planning and layout; runway and taxiway; grading and drainage; Design of Pavement

4. Construction Management

Construction as an industry, Basic concepts of management. Planning Organizing, controlling & Motivating. Different schools of management. Introduction to behavioral science, communication skills, leadership Applied psychology, project Formulation techno-economic study, multidisciplinary approach, budget allotment, Facets of construction Management-General M, personnel M, contract M, contract Labour M, Material M., organizational structure-work Flow and information flow. Two-party and three-party models. In-house and offloading.

Construction Infrastructure: Power, water, Access, Housing security, storage, plant, Maintenance, communication, Welfare. Enabling Works; personally; progress control; safety and Quality control. Planning and Scheduling Gantt chart, Milestone chart, PERT and CPM. Squared networks. Monitoring and updating. control on material consumption. Use of computer packages. Material procurement storage and accountancy. Labour management. Basic concepts in law, related to construction Laws; contract Labour (R&A), Act and rules, payment of wages Act, Minimum Wages Act, workman's compensation Act, Interstate Labour Act, Trade Union Act, Industrial Disputes Act.

Planning and Scheduling CPM and PERT Squared networks, Monitoring and updating. control on material consumption. Use of computer packages, Material procurement storage and accountancy. Contracts objective of contracting parties: Reconciliation of aims. Conflicts and problems, Standard from contracts, Type of contracts, their peculiarities and applications to repair job; Tendering process; Storing of materials with identifiable batch lot, documentation of incoming certificates, in-house checking and documentation of input materials, semi processed materials, finished materials. Quality assurance plan, Items of work. Method of measurement and documentation, Pricing rules of taking off, Principles of abstracting, Bill of quantities, Analysis of rate, Overhead and profit, Determination of unit rate, Specification of work.

ELECTRICAL ENGINEERING DEPARTMENT

Part 1: Research Methodology

1. Introduction to Research Methodology: motivation, objectives and goal, criterion of good research, research psychology.
2. Defining research problem: importance of defining research problem, industrial research problems and academic research problems, ways to define a research problem.
3. Research planning, features of good research planning.
4. Stages of practical experimentation; Design of experiments.
5. Measurement and data acquisition in research, importance of appropriate and meaningful data acquisition, selection of appropriate measuring instruments in research, errors in measurements,
6. Literature survey: importance of literature survey in research, selection of good references, survey papers.
7. Data analysis and statistical methods, interpretation of graphs and charts.
8. Engineering simulation: importance of simulation in research, simulation tools, basic building blocks of simulation studies.
9. Thesis organization: structure of a thesis, figures and illustrations, tables and charts, contents, index, thesis style.
10. Organization of technical papers; organization of reference; reference Style.

Reference: C.R. Kothari, Research Methodology: Methods & Techniques, New Age International Publishers, 2004

Part 2: Subjects in Electrical Engineering

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, 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.

Numerical Methods: Solutions of nonlinear algebraic equations, Single and Multi-step methods for differential equations.

Transform Theory: Fourier Transform, Laplace Transform, z-Transform.

Electrical Materials

Electrical Engineering Materials, crystal structures and defects, ceramic materials, insulating materials, magnetic materials – basics, properties and applications; ferrities, ferro-magnetic materials and components; basics of solid state physics, conductors; Photo-conductivity; Basics of Nano materials and Superconductors.

Electric Circuits

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

Field Theory

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.

Electrical and Electronic Measurements

Principles of measurement, accuracy, precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi-meters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis, Basics of sensors, Transducers, basics of data acquisition systems

Computer Fundamentals

Number systems, Boolean algebra, arithmetic functions, Basic Architecture, Central Processing Unit, I/O and Memory Organisation; peripheral devices, data representation and programming, basics of Operating system and networking, virtual memory, file systems; Elements of Programming languages, typical examples.

Analog and Digital Electronics

Basics of Semiconductor diodes and transistors characteristics, Junction and field effect transistors (BJT, FET and MOSFETS), different types of transistor amplifiers, equivalent circuits and frequency response; oscillators and other circuits, feedback amplifiers.

Operational amplifiers – characteristics and applications, combinational and sequential logic circuits, multiplexers, multi-vibrators, sample and hold circuits, A/D and D/A converters, basics of filter circuits and applications, simple active filters; Microprocessor basics- interfaces and applications, basics of linear integrated circuits; Analog communication basics, Modulation and demodulation, noise and bandwidth, transmitters and receivers, signal to noise ratio, digital communication basics, sampling, quantizing, coding, frequency and time domain multiplexing, power line carrier communication systems.

Systems and Signal Processing

Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier and Laplace transforms, Z transforms, Discrete Fourier transform, FFT, linear convolution, discrete cosine transform, FIR filter, IIR filter, bilinear transformation.

Control Systems

Mathematical modeling and representation of systems, Principles of feedback, transfer function, block diagrams and signal flow graphs, steady-state errors, transforms and their applications; Routh-hurwitz criterion, Nyquist techniques, Bode plots, root loci, lag, lead and lead-lag compensation, stability analysis, transient and frequency response analysis, state space model, state transition matrix, controllability and observability, linear state variable feedback, PID and industrial controllers.

Electrical Machines

Transformers– equivalent circuit, phasor diagram, parallel operation, auto-transformer, DC machines – types, characteristics, armature reaction and commutation, starting and speed control of motors, Induction motors – principles, types, performance characteristics, starting and speed control, Synchronous machines – performance, servo and stepper motors.

Power Systems

Basic power generation concepts, steam, gas and water turbines, corona and radio interference, power factor correction, symmetrical components, fault analysis, principles of protection systems, basics of solid state relays and digital protection; Circuit breakers, Radial and ring-main distribution systems, Matrix representation of power systems, load flow analysis, voltage control and economic operation, System stability concepts, Swing curves and equal area criterion. HVDC transmission and FACTS concepts, Concepts of power system dynamics, distributed generation, solar and wind power, smart grid concepts, environmental implications.

Power Electronics

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

Illumination Engineering

Fundamentals of Light-radiation and vision, quantities, units, standards and measurement. General classification of lamps: Incandescent, TL, CFL , white LEDs and HID lamps, basic principles of their operation. Laws of illumination.

Elementary Lighting Design- Definitions of design parameters. Basic luminaires classification and their distribution characteristics. Lighting calculations for indoor applications.

Lighting circuits for various lamps, Emergency lighting and Standby power sources.

ELECTRONICS & TELECOMMUNICATION ENGINEERING DEPARTMENT

Part 1: Research Methodology

Module I: Concept & Significance of Research

Significance of research, Objective of Research, Motivation of Research, Research methods vs Methodology , Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical Selection and formulation of Research Problem, Select a Research Topic , Steps/Stages in Narrowing a Research Topic , Steps for Successful Research

Module II : Research Design

Need for research Design, Research Methods : Traditional Methods – Historical, Institutional, Legal, Philosophical, Comparative, Ethical methods etc. Modern Methods: – Survey of Literature, Sampling method, Questionnaire, Schedule etc, Focus Group discussion, Observation Method, Case Study method, Content analysis, Statistical Method, Experimental method, Brainstorming Techniques etc. Selection of Appropriate Research Tools,

Module III: Report Writing

(a) Significance of Report Writing (b) Organization of the Research Report Preliminaries Like: Different steps in Writing Report, Layout of the Research Report, Bibliography, Appendices (c) Precautions for Writing Research Report like: IPR and Plagiarism

Reference:

1. <https://www.slideshare.net/Igustavomartins/research-methodology-10445096> (PPT on Research Methodology by Luís Gustavo Martins, Porto, Portugal)
3. Donald H. McBurney, “Research Methods”, Thomson Asia Pvt. Ltd., Singapore, 2002.
4. Kothari C. R., “Research Methodology and Techniques”, New Age International Publishers, 2nd Edition, New Delhi, 2004.

Part 2 : Syllabus for Electronics & Tele-Comm. Engg. Discipline

As per the Bachelor of Engineering (Electronics & Tele-Communication Engineering) available in the Jadavpur University website.

FOOD TECHNOLOGY & BIOCHEMICAL ENGINEERING DEPARTMENT

Part 1. Research Methodology

Linear and non linear algebraic equations. Concept of different numerical methods, integration by trapezoidal and Simpson's rules. Use of log-log and semi log papers. concept of independent & dependent variables; Data preparation and analysis : frequency tables, bar charts, pie charts, percentages, Error analysis. Concepts of accuracy, precision and resolution. Concept of mean, median, standard deviation ,curve fitting, correlation and regression. Concept of units and dimensions, Objectives of Research, Main components of any research work. Use of tools like Microsoft Excel, Microsoft PowerPoint, Use of Internet and search engines . Writing a research report; Plagiarism, Intellectual Property Issues.

Part 2: Subjects in Food Technology & BioChemical Engineering

Fermentative production of valuable products (amylase, alcohol, Baker's yeast, lactic acid, vinegar); microscope; Pasteurization; sterilization; bacterial growth curve; structural and physicochemical properties of carbohydrate, protein, lipid ,vitamin and natural pigment; units and dimensions; mass and energy balance; basic concept of chemical and enzymatic kinetics; Newtonian and non-Newtonian fluids; introduction to rheology of food materials; concept of canning; drying; freezing; irradiation and chemical preservative; Bioreactors (types and applications); Raw material and process steps for manufacturing of Bread , biscuit and ice-cream; objectives of food packaging and types of food packaging materials; food laws and regulations (FSSAI, FPO,AGMARK).

INFORMATION TECHNOLOGY DEPARTMENT

Part 1: Research Methodology

Ethics in research - legal issues, copyright, plagiarism. Purpose of writing report, Types of Report, Structure and Components of a research report, referencing report writing, how (and how not) to write a good conference/journal paper.

Elementary graphs: graph, tree, planner graph.

Combinatorics: Basic counting rules: sum rule, subtraction principle, product rule, division principle, permutations, combination.

Statistics: Mean, median, mode, standard deviation, correlation, regression, hypothesis testing.

Set Theory: countable and uncountable sets, relation, function, group, field.

Review of Probability Theory: Discrete Random Variable:- The p.m.f., distribution functions, analysis of program MAX, probability generating functions, independent random variables; Continuous Random Variable:- The p.d.f., exponential distribution, Binomial and Poisson distributions.

Part 2: Subjects in Information Technology

Data Structure: Array, Stack, Queue, Linked List, Tree, Binary Tree, Search Tree, Balanced Search Trees: AVL, Red Black tree, Graph Traversals, MST, Shortest path, Hashing, Sorting.

Algorithms: Greedy, Dynamic Programming, Heuristic Search, Complexity Analysis, NP Completeness, Approximation Algorithms.

Operating System: Process Management, Memory Management, CPU Scheduling, Process Synchronization, File Systems.

Networks: OSI reference model, TCP/IP reference model, Data Link Layer, Network Layer, Transport Layer, Local Area Networks.

Theoretical Computer Science: DFA, NFA, PDA, CSG, TM.

DBMS: ER Diagram, Relational Data Model, Normalization, Concurrency Management, Transaction Management, Recovery Management.

INSTRUMENTATION & ELECTRONICS ENGINEERING DEPARTMENT

Part 1: Research Methodology

1. Research Ethics and Codes of Practice: Types of Ethical Issues; Plagiarism-Definition and names of popular tools.
2. Matrix algebra, systems of linear equations, Eigen values and Eigen vectors
3. Calculus: Mean value theorem, maxima and minima,
4. Fourier series and Fourier Transform
5. Differential equations: First order equation (linear)
6. Statistics: Analysis of central tendency. Mean, median, mode, standard deviation; Probability, Sampling distribution; Estimation, Hypothesis testing & application; Correlation & regression analysis; Hypothesis testing; Test of Significance, 'p'-value, 't' test, chi-square test
7. Design of experiments – Methodology selection; Data collection and quantitative analysis of patterns- Orthogonal array, ANOVA.
8. Numerical methods –
 - a) Solution of algebraic equations: Newton Raphson method, Bisection method
 - b) Interpolation methods: Newton's forward and backward difference formulae.
 - c) Numerical integration: Numerical integration using Trapezoidal, Simpson's 1/3 rule
 - d) Fourth order Runge-Kutta method for solving first order equations

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd.
3. R.K.Jain & S.R.K. Iyengar, Advance Engineering Mathematics, Narosa Publishing House.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Montgomery, Douglas C. (2007) 5/e, Design and Analysis of Experiments (Wiley India).
6. Montgomery, Douglas C. & Runger, George C. (2007) 3/e, Applied Statistics & probability for Engineers (Wiley India).
7. Roig, M. Avoiding plagiarism, self-plagiarism, and other questionable writing practices: A guide to ethical writing, (2006).
8. Vaughan, L. Statistical methods for the information professional: A practical, painless approach to understanding, using and interpreting statistics (Ed. 2), (2004) Information Today, Medord.
9. J.B.Scarborough: Numerical Mathematical Analysis.

Part 2: Subjects in Instrumentation & Electronic Engineering

Fundamental of instrumentation:

SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision, repeatability and reproducibility, propagation of errors.

Industrial Instrumentation:

Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, pressure, flow (differential pressure, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level, pH, conductivity measurement.

Signals and Systems:

Laplace, Fourier and z - transforms; transfer function, frequency response of first and second order linear time invariant systems, impulse response of systems; convolution, correlation. Discrete time system: impulse response, frequency response, pulse transfer function; DFT and FFT; basics of IIR and FIR filters.

Control Systems:

Feedback principles, signal flow graphs, transient and steady state response analysis, Bode plot, phase and gain margins, Stability analysis using Routh and Nyquist criteria, root loci, design of lead, lag and lead-lag compensators, state-space representation of system, on-off, P, P-I, P-I-D control, Control valves.

Analog Electronics:

Characteristics of operational amplifiers; applications of opamps: difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier, precision rectifier, active filters. Oscillators, signal generators

Digital Electronics:

Combinational logic circuits, minimization of Boolean functions.

Arithmetic circuits, comparators, Schmitt trigger.

Sequential circuits, flip-flops, shift registers, timers and counters; sample-and-hold circuit, multiplexer, analog-to-digital (successive approximation, flash and sigma-delta) and digital-to-analog converters (weighted R, R-2R ladder); Basics of number systems, 8-bit microprocessor and microcontroller (Intel 8085 and 8051): applications, memory and input-output interfacing; basics of data acquisition systems.

Reference Books:

1. Kuo, B.C, and Golnaragh, F., Automatic Control Systems, Wiley
2. D. Roy Choudhury, Modern Control Engineering, Prentice-Hall Inc., 2005.
3. M. Gopal, Control Systems: Principles and Design, Tata McGraw Hill 3rd Edn, 2008.
4. Joseph J. Distefano, Allen J. Stubberud, and I. J. Williams. 1997. Schaum's Outline of Feedback and Control Systems (2nd ed.). McGraw-Hill Professional.
5. Taub, H. and Schilling, D., Digital Integrated Circuits, Mc Graw Hill
6. Coughlin, R.F., and Driscoll, F.F., Operational Amplifiers and Linear Integrated Circuits, Pearson
7. Manolakis, D. G., and Proakis, J. G., Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall.
8. Patranabis, D., Principles of Industrial Instrumentation, Tata McGraw Hill
9. Patranabis, D. Principles of Process Control, Tata McGraw Hill
10. D. V. S. Murthy, Transducers and Instrumentation, Prentice-Hall Inc. (2nd ed.), 2010.
11. A. K. Ghosh, Introduction to Measurements and Instrumentation, Prentice-Hall Inc. (4th ed.), 2012.
12. E. O. Doebelin, Measurement Systems: Application and Design, McGraw Hill (4th ed.), 1990.
13. J. P. Bentley, Principle of Measurement Systems, Pearson Education (4th ed.), 2005.

MECHANICAL ENGINEERING DEPARTMENT

Part 1: Research Methodology

Mathematics:

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms;

evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor

series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities,

directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Complex variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula;

Taylor and Laurent series.

Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations, interpolation and curve-fitting.

Experimental Methods and Measurements:

Theoretical, Computational and Experimental Research Methodologies. Objectives of Experiments: Monitoring,

Control and Research. System and Variable Identifications, Planning of Instrumentation, Design of Experiments.

Analog and Digital Measurements, Static and Dynamic Measurements. Accuracy, Precision, Sources of Errors in

Measurements, and Uncertainty Analysis. Performance Characteristics, Order of Instruments and Calibration.

Part 2: Subjects in Mechanical Engineering

Candidate must answer from any one section

Section 1: Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

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

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

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.

Section 2: Fluid Mechanics and Thermal Sciences:

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

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

Applications:

Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. **I.C. Engines:** Air-standard Otto, Diesel and dual cycles. Refrigeration and air conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes.

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

Section 3: Materials, Manufacturing and Industrial Engineering:

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

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

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

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; 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.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

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.

METALLURGICAL & MATERIAL ENGINEERING DEPARTMENT

Part 1: Research Methodology

Mathematics:

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima.

Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Probability and Statistics:

Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Numerical Methods:

Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations, interpolation and curve-fitting.

Experimental Methods and Measurements

Theoretical, Computational and Experimental Research Methodologies. Objectives of Experiments: Monitoring, Control and Research. System and Variable Identifications, Planning of Instrumentation, Design of Experiments.

Part 2: Subjects in Metallurgical & Material Engineering

GROUP – A IS COMPULSORY FOR ALL (20 MARKS)
ANY ONE SECTION FROM GROUPS B, C, D (30 MARKS)

GROUP – A

Crystal structure, atomic packing, solid solutions, phase rule, alloy definition, Hume Rothery Rule, binary isomorphous diagram, Fe-C phase diagram, X-Ray diffraction principles, Resolution of microscope, Optical magnification, Diffusion, Crystal defects, homogeneous and heterogeneous nucleation, segregation (coring), solidification time, conductors, semiconductors, insulators; composite structure.

GROUP – B

• Thermodynamics and Kinetics:

Free Energy of reactions, Equilibrium constant, Application of thermodynamics to produce metal from ores/waste, Ellingham diagram, Ideal and Non Ideal solution, Raoult's and Henry's laws, Chemical potential, Free Energy composition diagram, Gibbs Phase rule.

Homogeneous and Heterogeneous reaction, Rate of reactions, reaction mechanism from kinetics data, diffusion controlled, chemical controlled, contracting geometry, Activation Energy, Rate of

reaction dependent on temperature, pressure, concentration and particle size. Diffusion, Fick's 1st and 2nd laws of diffusion.

- **Pyro, Hydro and Electro metallurgical Process:**

Roasting, Smelting, matte smelting, converting for Metal sulphides/oxides/chlorides, Principle of Leaching of oxides/sulphides/ chlorides/ pure metal, E-pH diagram, Solvent extraction, Ion exchange, Electrowining, Electrorefining Aqueous solution and Fused salt electrolysis by Electrometallurgy.

- **Corrosion**

Electrochemical Principle of Corrosion, E-pH diagram, Corrosion of steel in aqueous environment, Polarization, Rate of corrosion, E_{corr} , I_{corr} , Forms of Corrosion, Atmospheric corrosion, Principle of corrosion protection by Inhibitor, coatings, anodic and cathodic protection.

- **Mineral Dressings**

Principle of Beneficiation of ore by sizing, sieve analysis, Magnetic separation, Gravity separation by Jigging, Tabling. Froth Floatation of sulphide ores.

- **Iron and Steel Technology**

Cokemaking. Review of Ironmaking Processes like Blast Furnace, Corex, DR Plant (coal & gas based) and other modern processes. Review of steelmaking processes like LD, LDAC, OBM, EAF, IF and other modern processes. Secondary steel making, deoxidation, desulphurization and degassing. Principles of alloy steel making process in view of stainless steel production, AOD, VOD. Casting pit practice, solidification defects & remedies, killed, semi killed & rimming steel. Continuous casting process. Basics of ferro alloy production. Principles and techniques of ferro alloy production like FeMn, FeCr, FeSi, SiMn, CaSi, FeTi, FeV, FeW, FeNb, FeNi, FeMo.

GROUP – C

- **Physical Metallurgy**

Steel and iron microstructures with phase relations, Free energy-composition diagrams. Diffusion: Diffusion laws, Kirkendall effect, activation energy, uphill diffusion etc. Solidification and solid-state transformation. Nucleation and growth reactions: Homogeneous & Heterogeneous nucleation. Dendritic solidification; Super cooling, Interface calculation etc. Segregation, precipitation reaction. Diffusional phase transformation process, massive transformation, recrystallisation, precipitation transformation, order disorder, eutectoid and spinoidal transformations. Optical microscopy: Construction, image formation and resolution

Phase transformation in steel, Kinetics of transformation, TTT & CCT curves, pearlitic transformation with different factors, characteristic of bainitic transformation, Diffusionless transformation; characteristics of martensitic transformation with stabilization and micro associated phenomena. Role of alloying elements in Steel-Equilibrium diagrams etc. Structure and properties. Alloy classification and families- Stainless steel, High speed steel etc. Heat treatment of different alloy steels, special heat treatment processes, atmospheres etc. Tool steels, bearing steels.

Hardenability, Different heat treatments- Annealing, Normalizing, Hardening, Tempering surface treatment etc. Thermo mechanical treatments, Different heating atmospheres and salt baths, Carburizing, nitriding and its varieties, and induction hardening.

- **Material Engineering**

Detailed description and metallurgy of following metals and their alloys-specifications, properties and applications - Cu, Al, Ti, and super alloys. Bearing, cryogenic, aerospace, nuclear, cutting tools, etc.

Materials for electrical contact, heating element, thermocouples, antifriction, magnetic materials, reactor, heat resistance, cryogenic purpose.

- **Heat treatment technology**

Heat treatment of different nonferrous metals. Failures and defects associated with heat treatment.

- **X-RAY & ELECTRON MICROSCOPY**

Stereographic projection. Reciprocal lattice concepts. Generation of X-Ray. Continuous and characteristic spectrum of X-ray. Filters. Coherent scattering and diffraction under nonideal conditions. Intensity of diffracted beams, Laue & Powder method. Indexing of cubic and non-cubic crystals. Application particle size determination, Electron microscopy principles.

GROUP – D

- **Casting Technology**

Foundry Fundamentals, Bonding, Sand & Clay, Testing, Solidification, Gating, Riser, Defects, Casting Processes, casting Design, Methoding, Steel and Iron castings, Light Metal Casting, New Casting Technologies.

- **Joining of Materials**

Fundamental of bonding, welding arc and arc physics, power sources for arc welding. Welding, Brazing, Soldering, Adhesive Bonding, Micro-joining, Micro-plasma, Micro-resistance, Ultrasonic Welding, Low Power Laser, Microwave Welding, Plastics & Ceramics, Joining of Advanced Materials, Defects in welded, brazed and soldered joints and its significance, Destructive and Non-destructive testing of welded joints, weldability test.

- **Plastic Deformation and Metal Working Processes**

Concepts of stress & plastic state of deformation – principal stress, normal stress, hydrostatic stress, shear stress etc., Yield Criteria – Von Mises and Tresca.

Critical resolved shear stress, Dislocation concept for plastic deformation, Types of dislocation, Dislocation reaction, Lomer-Cottrell barrier, Bauschinger Effect, Tensile, Fatigue, Creep and Impact behavior of metals, Strain rate sensitivity, strain hardening, superplasticity, Equicohesive temperature, Annealing process, Recrystallisation Temperature, Linear elastic fracture mechanics, Fracture Toughness.

Elements of metal deformation processes – Rolling: hot rolling & cold rolling; Forging: open die forging, closed die forging & press forging; Extrusion: direct, indirect & Aluminium extrusion; Wire drawing; Sheet metal working; Stretch forming for foils. Defects & limitations, thermomechanical processing, recovery, recrystallization and grain growth, microstructure development during forming.

PHARMACEUTICAL TECHNOLOGY DEPARTMENT

Part 1: Research Methodology:

- 1. Introduction to research:** Meaning, objective, motivation and types of research. Research and scientific method.
- 2. Research problem:** Selection, Necessity and technique of defining the problem.
- 3. Research Design:** Meaning and need for research design. Basic principles of research design.
- 4. Sampling Design:** Criteria and characteristic of good sample design. Random sample design.
- 5. Method of data collection:** Collection and observation. Different method of data collection.
- 6. Processing and analysis of data:** Problem in data processing. Statistics in research.
- 7. Testing of Hypothesis:** Basic concept and procedure for hypothesis testing.
- 8. Analysis of variance and covariance:** What is ANOVA, Basic principle of ANOVA, ANOVA Technique, Coding method, Two way ANOVA. ANOVA in latin-square design, Analysis of Co-variance.
- 9. Interpretation and Report Writing:** Meaning, Why, Technique, Precaution of interpretation. Significance of report writing, step involve in report writing, layout of research report.
- 10. The computer and its role in research.**

Part 2: Subjects in Pharmaceutical Technology

Analytical method development, Instrumentation method involve in drug and formulation research. Chromatographic techniques in drug development like HPLC, HPTLC, LC-MS, GC-MS, CPC etc.

Physicochemical factors regulating bioavailability, bioequivalence and ADME Parameter.

Drugs from their natural origin with therapeutics importance, their toxicity and regulation.

Combinatorial chemistry, HTS and deconvolution analysis. Lead finding in drug discovery and development (anti cancer, anti diabetic and cardiovascular drugs). Reaction mechanism and named reactions.

General consideration for newer delivery systems including Control and Sustained release systems. Outline of some alternative routes of drug delivery, ocular, transdermal, pulmonary, rectal and vaginal delivery. Liposomes, Fusogenic liposome, niosomes, multiple emulsion system.

Pharmacokinetics, Pharmacodynamics. Drug development , evaluation and safety studies.

Individual variants and drug interaction. Molecular basis of chemotherapy.

Chemotaxonomy of natural drug. Antitumor and Antidiabetic drugs of Natural origin.

Hallucinogenic, allergic and teratogenic drugs. Natural drug of steroid group.

Current drug discovery from natural origin.

Metabolic pathways. Elementary cytochemistry of mammalian bacterial and viral cell, importance of cytochemistry in drug development. Kinetic of enzyme reaction. Basis of metabolic antagonism. Chemistry of protein, lipid and carbohydrate.

Classification and taxonomy, structure and cytology, nutritional requirement, enzymes and metabolism by micro-organism. Method of cultivation of bacteria, fungi and viruses.

Sterilization and test for sterility, antibiotic, anti bodies, immunity. Gene therapy, Biotechnological products. Enzymes, Vitamins. Bacterial genetics.

POWER ENGINEERING DEPARTMENT

PART 1 : Research Methodology

1. **Measurement:** Concept of measurement. Scales of measurement - Nominal, Ordinal, Interval, Ratio. Error in measurement; Design of experiment, concept of independent & dependent variables; Data preparation and analysis (frequency tables, bar charts, pie charts, percentages), Error analysis. Concepts of accuracy, precision and resolution. Sensitivity analysis. Sample problems in measurement in research. (40%)

2. **Mathematical Review:** Concepts of set theory and probability, Linear algebraic equations. Differential equations – linear ODEs and PDEs. Complex numbers, Statistical methods, Concept of central tendencies, measurement of dispersion. Curve fitting, correlation and regression. Concept of different numerical methods. (40%)

3. **Background of Basic Physical Science for Research:** Concept of units and dimensions, Basics of Solid mechanics, thermodynamics, hydraulics, and electrodynamics. (20%)

PART 2: Subjects in Power Engineering

The candidates have to answer either Group A or Group B

Group A: Syllabus as in Mechanical Engineering, GATE, 2017

Group B: Syllabus as in Electrical Engineering, GATE 2017

PRINTING ENGINEERING DEPARTMENT

SYLLABUS FOR PH.D. ENTRANCE EXAMINATIONS

Part 1: Research Methodology

1. Type of Researches
2. Steps in sample Design and sample selection criteria
3. Measurement Scales, method of paired comparison
4. Sources of measurement error
5. Test of Validity, reliability, practicability etc.
6. Observation method, interview method and other method of primary data collection.
7. Data processing operations
8. Central limit theorem
9. Hypothesis testing of mean.
10. Chi-square test of variance comparison
11. Basic principle of ANOVA
12. Interpretation techniques and precautions of interpretation.
13. Steps of report writing

Part 2: Subjects in Printing Engineering

B.E. Printing Engineering Syllabus as available in Jadavpur University Website

PRODUCTION ENGINEERING DEPARTMENT

Part 1: Research methodology

Overview of research methodology, Data collection & presentation, Review of Basic statistical measure, Probability Distributions, Sampling methods & Distribution, Tests of Hypotheses, Non-Parametric tests, Design of Experiment, Basic multivariate analysis, Theory of optimization.

Part 2: Subjects in Production Engineering

Engineering Mathematics

Linear Algebra: Matrix algebra, Systems of linear equations, Eigen values and eigen vectors.

Calculus: Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

Complex variables: Analytic functions, Cauchy's integral theorem, Taylor series.

Probability and Statistics: Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

General Engineering

Engineering Materials: Structure and properties correlation; engineering materials (metals, ceramics, polymers and composites) – properties and applications; stress-strain behavior of metals and alloys; iron-carbon phase diagram, heat treatment of metals and alloys, its influence on mechanical properties.

Applied Mechanics: 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 stress, Euler's theory of columns.

Theory of Machines and Design: Analysis of planar mechanisms, cams and followers; governors and fly wheels; design of bolted, riveted and welded joints; interference/shrink fit joints; design of shafts, keys, spur gears, belt drives, brakes and clutches; pressure vessels.

Thermal and Fluids Engineering: Fluid mechanics – fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum, capillary action, contact angle and wetting; thermodynamics – zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; heat transfer – basic applications of conduction, convection and radiation.

Manufacturing Processes I

Casting: types of casting processes and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; analysis of solidification and microstructure development; design of gating and riser; origin of defects.

Metal Forming: Stress-strain relations in elastic and plastic deformation; concept of flow stress; hot and cold working – forging, rolling, extrusion and wire drawing; sheet metal working processes – blanking, bending and deep drawing; ideal work and slab analysis; origin of metal working defects.

Joining of materials: Principles of fusion welding processes (manual metal arc, MIG, TIG, plasma arc, submerged arc welding processes) – different heat sources (flame, arc, resistive, laser, electron beam), and heat transfer and associated losses, flux application, feeding of filler rod; Principles of solid state welding processes (friction, explosive welding, ultrasonic welding processes); Principles of adhesive, brazing and soldering processes; Origins of welding defects.

Powder processing: Production of metal/ceramic powders, compaction and sintering of metals and ceramic powders.

Polymers and Composites: Plastic processing – injection, compression and blow molding, extrusion, calendaring and thermoforming; molding of composites.

Manufacturing Processes II

Machine Tools and Machining: Basic machine tools like centre lathe, milling machine, and drilling machine – construction and kinematics; machining processes - turning, taper turning, thread cutting, drilling, boring, milling, gear cutting, thread production, grinding; geometry of single point cutting tools, chip formation, cutting forces, specific cutting energy and power requirements, Merchant's analysis; basis of selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; Jigs and fixtures – principles, applications, and design

Non-traditional Manufacturing: Principles, applications, effect of process parameters on MRR and product quality of non-traditional machining processes – USM, AJM, WJM, AWJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

Computer Integrated Manufacturing: Basic concepts of CAD – geometric modeling, CAM – CNC and robotics – configurations, drives and controls, Group Technology and its applications – CAPP, cellular manufacturing and FMS.

Quality and Reliability

Metrology and Inspection: Limits, fits, and tolerances, gauge design, interchangeability, selective assembly; linear, angular, and form measurements (straightness, squareness, flatness, roundness, and cylindricity) by mechanical and optical methods; inspection of screw threads and gears; surface finish measurement by contact and non-contact methods; tolerance analysis in manufacturing and assembly.

Quality management: Quality – concept and costs; quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000.

Reliability and Maintenance: Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; determination of system reliability; preventive maintenance and replacement.

Industrial Engineering

Product Design and Development: Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification,

diversification, value engineering and analysis, concurrent engineering; comparison of production alternatives.

Work System Design: Taylor's scientific management, Gilbreth's contributions; productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement – time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration.

Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

Operations research and Operations management

Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models, constrained optimization and Lagrange multipliers; Markovian queuing models; dynamic programming; simulation – manufacturing applications.

Engineering Economy and Costing: Elementary cost accounting and methods of depreciation; break-even analysis, techniques for evaluation of capital investments, financial statements, time-cost trade-off, resource leveling.

Production control: Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; MRP and MRP-II; routing, scheduling and priority dispatching; Push and pull production systems, concept of JIT manufacturing system; Logistics, distribution, and supply chain management; Inventory – functions, costs, classifications, deterministic inventory models, quantity discount; perpetual and periodic inventory control systems.

Project management – PERT and CPM.