VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY: BURLA

(Formerly University College of Engineering, Burla-Established by Govt. Odisha in 1956 & Upgraded in 2009 to A State Govt. University Covered under Section 2(f) & 12(B) of UGC Act.)

P.O.: Engineering College, Burla (Siddhi Vihar), Dist: Sambalpur Odisha-768018, India

Website: www.vssut.ac.in

No.VSSUT/PGSR/ 952 /21 DATE: 27/07/2021

Online Entrance Test and online Interview for the admission into Ph.D Programmes: AUTUMN -2021 will be held for the shortlisted candidates as per the schedule mentioned below. Candidates shortlisted under Non-Exempted category have to appear online entrance test and interview (if qualified in the entrance test). The candidates shortlisted under Exempted category have to appear online interview. **No separate intimation for appearing on the Online Entrance Test/ Online Interview shall be sent to the candidates.**The guidelines for online entrance test, online interview, and syllabus for entrance test are mentioned below. For updates, all the candidates are required to visitUniversity website: www.vssut.ac.in.

Enclosed:

1) Important Dates

2) Admission Fees

3) List of Eligible candiates under Non-exmpted and Exempted category.

4) Guidelines for Online Entance Test and Online-Interview.

5) Guidelines for Online Counselling-Cum-Admission

6) Syllabus for Online Entrance Test

27/7/21

1.Important Dates

12.08.2021 (10.00 AM to 11.00 AM)	Online Entrance Test	Chemical Engg. Civil Engg., Computer Application, Electrical Engg., EEE, Humanities
13.08.2021 (10.00 AM to 11.00 AM)		Architecture, Computer Sc. &Engg, Metallurgical & Materials Engg., Production Engg.
14.08.2021 (10.00 AM to 11.00 AM)		Chemistry, Information Technology, Mathematics, Mechanical Engg., Physics
16.08.2021	Results of Online Entrance Test	
18.08.2021 (10.00 AM to 1.00 PM)	Online Interview	Chemical Engg. Civil Engg., Computer Application, Electrical Engg., EEE, Humanities
18.08.2021 (3.00 PM to 5.00 PM)		Architecture, Computer Sc. &Engg, Metallurgical & Materials Engg, Production Engg.
20.08.2021 (10.00 AM to 1.00 PM)		Chemistry, Information Technology, Mathematics, Mechanical Engg., Physics
28.08.2021	Declaration of final results	
31.08.2021 (Onwards)	Online Counselling-Cum-Admission	

2. Admission Fees

Regular Day Scholar	Rs. 29,140/- (Admission Fee) (For 1st and 2nd semester).
Regular Boarder*	Rs. 29,140/- (Admission Fee) Rs. 12,680/- (Hostel Accommodation excluding mess charge)

*** Mess fee will be charged only after confirmation of Hostel Accommodation**

3. Shortlisted Candidates Under Non-Exmpted And Exempted Category

SL. NO	APPLICATION ID	DEPARTMENT	NAME OF THE CANDIDATE	CATEGORY
1	1004118	ARCHITECTURE	RASMI RANJAN SWAIN	EXEMPTED
2	1004260	CHEMICAL ENGG.	DEVI PRASAD MISHRA	NON-EXEMPTED
3	1004668	CHEMICAL ENGG.	SURENDRA NATH DANDASENA	NON-EXEMPTED
4	1002394	CHEMISTRY	PABITRA MOHAN MAHAPATRA	NON-EXEMPTED

27/7/21

5	1002725	CHEMISTRY	PRIYANKA BEHERA	NON-EXEMPTED
6	1002853	CHEMISTRY	GYANENDRA PRASAD PANDA	NON-EXEMPTED
7	1002864	CHEMISTRY	NARAYAN SAHOO	NON-EXEMPTED
8	1002899	CHEMISTRY	SUBHRASMITA DASH	NON-EXEMPTED
9	1003376	CHEMISTRY	BHAKTIPRASAD SETHY	NON-EXEMPTED
10	1003586	CHEMISTRY	KRISHNA MANJARI SAHU	NON-EXEMPTED
11	1003599	CHEMISTRY	SUSOBHAN SWAIN	NON-EXEMPTED
12	1003887	CHEMISTRY	PRATIKSHYA DAS PATTANAYAK	NON-EXEMPTED
13	1004705	CHEMISTRY	PRAGYAN PARIMITA DASH	NON-EXEMPTED
14	1005062	CHEMISTRY	SHUVENDU SHUVANKAR PUROHIT	NON-EXEMPTED
15	1002499	CIVIL ENGG.	SATYAJEET PATNAIK	NON-EXEMPTED
16	1002501	CIVIL ENGG.	SUBRATA PRADHAN	NON-EXEMPTED
17	1002503	CIVIL ENGG.	MANORANJAN DASH	NON-EXEMPTED
18	1002929	CIVIL ENGG.	SUKHENDU BIKASH BANERJEE	NON-EXEMPTED
19	1003014	CIVIL ENGG.	SIDHARTHA BARAL	NON-EXEMPTED
20	1003124	CIVIL ENGG.	PRITEE KRISHNA DAS	NON-EXEMPTED
21	1003228	CIVIL ENGG.	SUCHISMITA BEHERA	NON-EXEMPTED
22	1003418	CIVIL ENGG.	BISWA RANJAN TRIPATHY	NON-EXEMPTED
23	1003465	CIVIL ENGG.	SACHIKANTA PRADHAN	NON-EXEMPTED
24	1003611	CIVIL ENGG.	SUBHASHREE ROUT	NON-EXEMPTED
25	1003741	CIVIL ENGG.	RUPASHREE SAHOO	NON-EXEMPTED
26	1003830	CIVIL ENGG.	RAMAHARI RATH	NON-EXEMPTED
27	1003964	CIVIL ENGG.	SAHIL PRITAM SWAIN	NON-EXEMPTED
28	1004437	CIVIL ENGG.	DEEPTI RANJAN MOHAPATRA	NON-EXEMPTED
29	1004479	CIVIL ENGG.	JHARANA PRADHAN	NON-EXEMPTED
30	1004912	CIVIL ENGG.	NIHARIKA PATTANAYAK	NON-EXEMPTED
31	1004989	CIVIL ENGG.	SHRADHANJALEE PRADHAN	NON-EXEMPTED
32	1005066	CIVIL ENGG.	ARNAB MITRA	EXEMPTED
33	1005074	CIVIL ENGG.	RANJITA DAS	NON-EXEMPTED
34	1002333	COMPUTER APPLICATIONS	ALOKA NATHA	NON-EXEMPTED

Spanda 27/7/21

35	1002829	COMPUTER APPLICATIONS	RABINDRA PATEL	EXEMPTED
36	1003430	COMPUTER APPLICATIONS	BISHNUPRIYA DASH	NON-EXEMPTED
37	1004112	COMPUTER APPLICATIONS	PRATIBHA KUMARI KHANDUAL	NON-EXEMPTED
38	1004784	COMPUTER APPLICATIONS	PUJA DAS	NON-EXEMPTED
39	1004992	COMPUTER APPLICATIONS	MAHENDRA PRATAP PANIGRAHY	NON-EXEMPTED
40	1002222	COMPUTER SC. & ENGG.	SASMITA KUMARI PRADHAN	NON-EXEMPTED
41	1002590	COMPUTER SC. & ENGG.	YUGANDHAR MANCHALA	NON-EXEMPTED
42	1002721	COMPUTER SC. & ENGG.	ABHIJEET MAHAPATRA	NON-EXEMPTED
43	1002740	COMPUTER SC. & ENGG.	SUDESHNA PATTANAIK	NON-EXEMPTED
44	1002906	COMPUTER SC. & ENGG.	SUKANT KUMAR SAHOO	NON-EXEMPTED
45	1002922	COMPUTER SC. & ENGG.	SANTOSINI BISOYI	NON-EXEMPTED
46	1003010	COMPUTER SC. & ENGG.	SLOKASHREE PADHI	NON-EXEMPTED
47	1003119	COMPUTER SC. & ENGG.	ARCHANA SENAPATI	NON-EXEMPTED
48	1003317	COMPUTER SC. & ENGG.	SANEEV KUMAR DAS	NON-EXEMPTED
49	1003387	COMPUTER SC. & ENGG.	VENKATA LAKSHMI NARAYANA GORLE	NON-EXEMPTED
50	1003426	COMPUTER SC. & ENGG.	CHALAPATHI RAO TIPPANA	NON-EXEMPTED
51	1003439	COMPUTER SC. & ENGG.	LENKA VENKATA SATYANARAYANA	NON-EXEMPTED
52	1003483	COMPUTER SC. & ENGG.	CHINTA CHANDRA SEKHAR	NON-EXEMPTED
53	1004063	COMPUTER SC. & ENGG.	TARUN KUMAR BEHERA	NON-EXEMPTED
54	1004155	COMPUTER SC. & ENGG.	PREETI NUTIPALLI	NON-EXEMPTED
55	1004819	COMPUTER SC. & ENGG.	PUJA DAS	NON-EXEMPTED
56	1005159	COMPUTER SC. & ENGG.	MONALISA CHAKRABORTY	NON-EXEMPTED
57	1002306	ELECTRICAL & ELECTRONICS ENGINEERING	SUBHASMITA MOHANTY	NON-EXEMPTED
58	1002702	ELECTRICAL ENGG.	MANASI PATRO	NON-EXEMPTED
59	1003188	ELECTRICAL ENGG.	AMIT MALLICK	EXEMPTED
60	1003684	ELECTRICAL ENGG.	GIRIJA SANKAR PANIGRAHI	EXEMPTED
61	1004424	ELECTRICAL ENGG.	ASTAMITA MISHRA	NON-EXEMPTED
62	1004559	ELECTRICAL ENGG.	RAMPREET MANJHI	NON-EXEMPTED
63	1005075	ELECTRICAL ENGG.	BODHISATWA BHATTACHARYA	NON-EXEMPTED
64	1002828	ELECTRONICS & TC. ENGG.	AMRUTA PANDA	NON-EXEMPTED

27/7/24

65	1002860	ELECTRONICS & TC. ENGG.	MOHAN CHANDRA PRADHAN	NON-EXEMPTED
66	1002941	ELECTRONICS & TC. ENGG.	SARTHAK PANDA	NON-EXEMPTED
67	1003090	ELECTRONICS & TC. ENGG.	PRANSHU JENA	NON-EXEMPTED
68	1003660	ELECTRONICS & TC. ENGG.	SWADHIN KUMAR MISHRA	NON-EXEMPTED
69	1003920	ELECTRONICS & TC. ENGG.	ANKITA PATRA	NON-EXEMPTED
70	1004334	ELECTRONICS & TC. ENGG.	BHAWESH KUMAR CHAUDHARY	NON-EXEMPTED
71	1004494	ELECTRONICS & TC. ENGG.	ANURUPA KAR	NON-EXEMPTED
72	1004999	ELECTRONICS & TC. ENGG.	RATIRANJAN SENAPATI	NON-EXEMPTED
73	1002289	ENGLISH	SABAN KUMAR BAGH	NON-EXEMPTED
74	1002345	ENGLISH	JUHI RAZA	NON-EXEMPTED
75	1003001	ENGLISH	ANAND PRAKASH PATHAK	NON-EXEMPTED
76	1003922	ENGLISH	ANANYA RATHA	NON-EXEMPTED
77	1003982	ENGLISH	SIDDHARTH BARAL	EXEMPTED
78	1004085	ENGLISH	SIBANI MALI	NON-EXEMPTED
79	1004593	ENGLISH	PUJARANI BEHERA	NON-EXEMPTED
80	1004918	ENGLISH	ADBET PADHAN	EXEMPTED
81	1005218	ENGLISH	APURV SHAHI	NON-EXEMPTED
82	1002691	INFORMATION TECH.	YUGANDHAR MANCHALA	NON-EXEMPTED
83	1002734	INFORMATION TECH.	SASMITA BEHERA	EXEMPTED
84	1002818	INFORMATION TECH.	SASMITA KUMARI PRADHAN	NON-EXEMPTED
85	1002894	INFORMATION TECH.	BIJAYA KUMAR GOUDA	NON-EXEMPTED
86	1002895	INFORMATION TECH.	JAYASHREE RANA	NON-EXEMPTED
87	1003121	INFORMATION TECH.	LENKA VENKATA SATYANARAYANA	NON-EXEMPTED
88	1003218	INFORMATION TECH.	ASHISH SINGH SALUJA	NON-EXEMPTED
89	1003313	INFORMATION TECH.	SLOKASHREE PADHI	NON-EXEMPTED
90	1003447	INFORMATION TECH.	LENKA VENKATA SATYANARAYANA	NON-EXEMPTED
91	1003457	INFORMATION TECH.	CHINTA CHANDRA SEKHAR	NON-EXEMPTED
92	1003478	INFORMATION TECH.	CHALAPATHI RAO TIPPANA	NON-EXEMPTED
93	1004160	INFORMATION TECH.	PREETI NUTIPALLI	NON-EXEMPTED
94	1004428	INFORMATION TECH.	SANTOSINI BISOYI	NON-EXEMPTED
95	1002627	MATHEMATICS	SUDIPTA PRIYADARSHINI	NON-EXEMPTED

27/7/24

96	1004477	MATHEMATICS	ASHIRBAD KUMAR RATH	NON-EXEMPTED
97	1004571	MATHEMATICS	LIPSA BEHERA	NON-EXEMPTED
98	1005051	MATHEMATICS	SASMITA DAS	EXEMPTED
99	1005183	MATHEMATICS	SIPRARANI SAHOO	NON-EXEMPTED
100	1002382	MECHANICAL ENGG.	ASHUTOSH SATPATHY	NON-EXEMPTED
101	1002665	MECHANICAL ENGG.	SAIBIKASH PRUSTY	NON-EXEMPTED
102	1002901	MECHANICAL ENGG.	KALYANI LOHAR	NON-EXEMPTED
103	1003039	MECHANICAL ENGG.	RAKESH KUMAR SAHOO	NON-EXEMPTED
104	1003089	MECHANICAL ENGG.	CHINMAY SUNDAR DASH	NON-EXEMPTED
105	1003330	MECHANICAL ENGG.	VENKATA SAI KARTHIK KOPPALA	NON-EXEMPTED
106	1003401	MECHANICAL ENGG.	AYAN SENGUPTA	NON-EXEMPTED
107	1003425	MECHANICAL ENGG.	DURGA PRASAD SAHOO	EXEMPTED
108	1003500	MECHANICAL ENGG.	SUDHIR KUMAR MAHANTA	NON-EXEMPTED
109	1004125	MECHANICAL ENGG.	DEBASISH ROUT	NON-EXEMPTED
110	1004195	MECHANICAL ENGG.	SUMIT SAGAR HOTA	EXEMPTED
111	1004264	MECHANICAL ENGG.	PRASANNA KUMAR MALLA	EXEMPTED
112	1004364	MECHANICAL ENGG.	PRIYABRATA PANDA	NON-EXEMPTED
113	1004813	MECHANICAL ENGG.	ANANYA MAHAPATRA	NON-EXEMPTED
114	1004816	MECHANICAL ENGG.	SIMARANI BEHERA	NON-EXEMPTED
115	1003819	METALLURGICAL & MATERIALS ENGG.	DEBABRATA DAS	NON-EXEMPTED
116	1004200	METALLURGICAL & MATERIALS ENGG.	ABINASH PRADHAN	EXEMPTED
117	1002803	PHYSICS	IPSITA CHIHNARA	NON-EXEMPTED
118	1002854	PHYSICS	GAYATRI DASH	NON-EXEMPTED
119	1003118	PHYSICS	DEBASHISH SAHA	NON-EXEMPTED
120	1003236	PHYSICS	MRUTYUNJAY JENA	NON-EXEMPTED
121	1003300	PHYSICS	MAUSUMI MAHAPATRA	NON-EXEMPTED
122	1004780	PHYSICS	SHUBHAKESHI SAHOO	NON-EXEMPTED
123	1004236	PRODUCTION ENGG.	AMRUTA PANDA	NON-EXEMPTED
124	1004474	PRODUCTION ENGG.	ABINASH PRADHAN	EXEMPTED
125	1004623	PRODUCTION	SUDHIR KUMAR MAHANTA	NON-

27/7/21

		ENGG.		EXEMPTED
126	1004670	PRODUCTION ENGG.	DEBASISH ROUT	NON-EXEMPTED

4. Guidelines for Online Entrance Test and Interview

- Question paper for the online mode for the entrance tests will consist of 50 questions based on outcome based education, which will test the applied knowledge of the students opting for VSSUT Programmes.
- **Each question will carry 2 marks. All questions are compulsory. For each wrong answer 0.5 mark will be deducted**.
- Duration of examination is one hour.
- Question paper will be sent to the eligible candidates in their registered e-mail before 10 minutes of commencement of the examination.
- Additional time of 10 minutes will be provided for submitting the answer in Google form.
- Duration of excludes 10 minutes, the time from receiving the question paper, and 10 minutes to submit the answer. (Total 80 minutes from receiving the question)
- Question papers sent by e-mail are strictly confidential. Candidate must not share the questions with any other during the examination process. If anyone is detected in doing this through the underneath mechanism, then the candidate will be excluded according to the existing rules pertaining to "UNFAIR MEANS IN THE EXAMINATION".
- Answer sheet in original or soft form (pdf/scanned copy/photo etc.) Are strictly confidential. Candidate must not share those neither during the examination process nor even after the examination till results are declared. If anyone is detected in doing this through the underneath mechanism, then the candidate will be excluded according to the existing rules pertaining to "involved in gross misconduct in examination".
- IF ANY CANDIDATE FAILS TO SUBMIT THE ANSWER IN STIPULATED TIME, HIS/HER ANSWER WILLBE REJECTED AT SERVER AND EVALUATION WILL NOT POSSIBLE DONE.
- One PDF attachment (containing 50 questions), and a Google form link for online answer submission will be sent to the registered email id of the candidate. Candidates are advised to read the questions carefully and answer on the online answer sheet within the time limit.

27/7/21

- Submit the online answer sheet as early as possible, after completion of the examination to avoid last minute rush on the server.
- (For illustration: Let us consider that question via email is received at 9:50A.M, theexamination is started at 10:00A.M and the schedule end time at 11:00A.M. The candidatesare required to press the submit button before 11:10A.M positively, failing which the answerssheet will be rejected by the server.)
- The online Viva-Voce for the candidates with exempted category and those qualified after the written test, will be conducted as per the schedule mentioned above via Google Meet online platform. The link for the interview will be sent to the registered email Id.

5. Guidelines for Online-Counselling-cum-Admission Process

- Further, all are requested to read the detailed information carefully as the entire process will be done online.
- Offer letter for the admission into Ph.D Programmes Autumn-2021 will be sent to the registered E-mail address of the qualified candidates.
- Admission offer will be from the VSSUT domain email i.d.(...@vssut.ac.in).
- Candidates will be given three days time to deposit the Admission Fees. Link for the payment of the Admission fee will be provided later.
- If a candidate fails to deposit Admission Fees within three days, then the offered seat will be forfeited and will be declared vacant and the next candidate on the merit list will be sent an offer letter. (It is strongly advised that the candidates must be ready for online transfer of fees in full to confirm his/her seat).
- The payment of Admission fees confirms the provisional admission into the Ph.D Programmes Autumn-2021.
- For the completion of the admission process, the candidates have to physically report for certificate verification at VSSUT, Burla. The date of Physical Reporting will be notified later.
- All the admitted candidates have to retain and produce payment slips of Counselling Fees and Admission Fees, at the time of Physical Reporting.

27/7/21

6. SYLLABUS FOR ONLINE ENTRANCE TEST

CIVIL ENGINEERING

1. Engineering Mechanics, Strength of Materials and Structural Analysis

Engineering Mechanics: Principle of virtual work, equivalent force system.First and Second Moment of area, Mass moment of Inertia.Static Friction. Kinematics and Kinetics: Kinematics in Cartesian Coordinates, motion under uniform and nonuniform acceleration, motion under gravity. Kinetics of particle: Momentum and Energy principles, collision of elastic bodies, rotation of rigid bodies.

Strength of Materials: Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, Shear Stress distribution across cross sections, Beams of uniform strength. Deflection of beams: Macaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Elastic stability of columns, Euler's Rankine's and Secant formulae.

Structural Analysis: Castiglianio's theorems, Slopedeflection, moment distribution, Rolling loads and Influences lines: Influences lines for Shear Force and Bending moment at a section of beam. Criteria for maximum shear force and bending Moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses. Arches: Three hinged, two hinged and fixed arches. Matrix methods of analysis Plastic Analysis of beams and frames: Theory of plastic bending, plastic analysis, statical method, Mechanism method. Unsymmetrical bending: Moment of inertia, product of inertia, Neutral Axis and Principle axes, bending stresses.

2. Design of Structures: Steel, Concrete

Structural Steel Design: Structural Steel: Riveted, bolted and welded joints and connections. Design of tension and compression member, beams of built up section, riveted and welded plate girders, gantry girders, stancheons with battens and lacings.

Design of Concrete : Concept of mix design. Reinforced Concrete: Working Stress and Limit State method of design-Recommendations of I.S. codes Design of one way and two way slabs, stair-case slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity, Cantilever and Counter fort type retaining walls. Prestressed concrete: Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress.

3. Fluid Mechanics, Open Channel Flow, Hydraulic Machines, Hydrology, Water Resources and

Engineering:

Fluid Mechanics: Fluid properties and their role in fluid motion, fluid statics, Kinematics and Dynamics of Fluid flow,.Continuity, momentum and energy equation, Navier-Stokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, sluice gates, weirs. Laminar flow between parallel, stationary and moving plates, flow through tube. Laminar and turbulent boundary layer on a flat plate, laminar sub layer, smooth and rough boundaries, drag and lift. Turbulent flow through pipes: Characteris-tics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line. Uniform and non-uniform flows, Hydraulic turbines, types classification, Choice of turbines, performance parameters, controls, characteristics, specific speed.

27/7/24

Hydrology: Hydrological cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analysis, flood routing through a reservoir, channel flow routing Muskingam method.

Water Resources Engineering: Ground and surface water resource, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.

Irrigation Engineering: (i) Water requirements of crops: consumptive use, duty and delta, irrigation methods and their efficiencies. (ii) Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load. (iii) Canal structures (iv) Diversion headwork: Principles and design of weirs of permeable and impermeable foundation, Khosla's theory, energy dissipation. (v) Storage works (vi) Spillways (viii) River training:.

4. Geotechnical Engineering: Soil Type and structure - gradation and particle size distribution - consistency limits. Water in soil - capillary and structural - effective stress and pore water pressure - permeability concept - field and laboratory determination of permeability - Seepage pressure - quick sand conditions - Shear strength determination - Mohr Coulomb concept.Compaction of soil - Laboratory and field tests.Compressibility and consolidation concept - consolidation theory - consolidation settlement analysis.Earth pressure theory and analysis for retaining walls, Application for sheet piles and Braced excavation. Bearing capacity of soil - approaches for analysis - settlement analysis - stability of slope of earth walk. Subsurface exploration of soils - methods Foundation - Type and selection criteria for foundation of structures - Design criteria for foundation - Analysis of distribution of stress for footings and pile - pile group action-pile load test. Ground improvement techniques.

5. Transportation Engineering :

Railway Engineering: Permanent way - components, types and their functions - Functions and Design of turn and crossings - Necessity of geometric design of track - Design of station and yards.

Highway Engineering: Principles of Highway alignments - classification and geometrical design elements and standards for Roads. Design principles and methodology of flexible and rigid pavements. Typical construction methods and standards of materials for stabilized soil, WBM, Bituminous works and CC roads. Surface and sub-surface drainage arrangements for roads. Pavement distresses and strengthening by overlays. Traffic surveys and their applications in traffic planning - Typical design features for channelized, intersection, rotary etc - signal designs - standard Traffic signs and markings.

6. Environmental Engineering:

Water Supply: Predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water. Water treatment: principles of coagulation, flocculation and sedimentation; slow-; rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity.

Sewerage systems: Domestic and industrial wastes, storm sewage-separate and combined systems, flow through sewers, design of sewers.BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal watercourse and on land.

Sewage treatment & Solid waste: Working principles, units, chambers, sedimentation tanks, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water. Collection and disposal in rural and urban contexts, management of long-term ill effects.

27/7/21

MECHANICAL ENGINEERING

Section 1: Applied Mechanics and Design

Engineering Mechanics:

Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamicsof particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) andenergy 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; deflectionof 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 hardnessand impact strength.

Theory of Machines:

Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis oflinkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating androtating masses; gyroscope.

Vibrations:

Free and forced vibration of single degree of freedom systems, effect of damping; vibrationisolation; 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 offloating 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 throughpipes, head losses in pipes, bends and fittings.

Heat-Transfer:

Modes of heat transfer; one dimensional heat conduction, resistance concept and electricalanalogy, heat transfer through fins; unsteady heat conduction, lumped parameter system,Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convectiveheat transfer, heat transfer correlations for flow over flat plates and through pipes, effect ofturbulence; heat exchanger performance, LMTD and NTU methods; radiativeheat transfer,StefanBoltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiationnetwork analysis.

Thermodynamics:

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

Applications:

27/7/24

Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts ofregeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigerationand air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air,psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reactionprinciples, 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-straindiagrams for engineering materials.

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

Machining and Machine Tool Operations:

Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometryand materials, tool life and wear; economics of machining; principles of non-traditionalmachining 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 analysisin 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, simplemodels, PERT and CPM.

ELECTRICAL ENGINEERING& EEE

Networks: Network topology, Node-pair and loop analysis of networks containing independent and dependent sources, Sinusoidal steady state analysis of single-phase and 3-phase circuits, Resonance, Symmetrical components, Magnetically coupled circuits. Fourier series and transform, Laplace transform, Analysis of RLC networks using Laplace transform, Network functions for one-port and twoport networks, Impulse response and superposition integral, Network theorems, State variables, Formulation of state equations of

27/7/21

RLC-networks and solutions, Discrete systems.

Signals and Systems: Definitions and properties of Laplace transform, continuous-time and discretetime Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem, Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

Electromagnetic Field Theory: Vector fields. Divergence and Stokes theorems.Overview of Electrostatics and Magnetostatics. Poisson's Equation: Derivation, applications, existence and uniqueness. Dielectrics, Displacement vector.Capacitance matrix, Energy in the field. Ampere's Law: B Field calculations. Vector potential.The magnetic dipole. Magnetization of materials.Faraday's Law: Induced emf in stationary and moving coils. Inductance.Inductancematrix.Energy in the magnetic field. Maxwell's Equation: The wave equation. Poyntingtheorem.Poynting theorem for phasors.

Electrical Machines: Single phase transformer, three phase transformers, instrument transformers, energy conversion principles, DC machines, induction motors, synchronous machines, parallel operation of generators, motor starting, characteristics and applications, servo and stepper motors, special machines, electrical drives.

Power Systems and High Voltage: Basic power generation concepts, transmission line models and performance, cable performance, insulation, corona and radio interference, distribution systems, per-unit quantities, bus impedance and admittance matrices, load flow, voltage control, power factor correction, economic operation, symmetrical components, fault analysis, power system protection and switch gear, HVDC transmission and FACTS concepts, power quality, Harmonics in power systems, Renewable energy systems. Power System Stability -Swing equation, single generator infinite bus model, and equal area criterion. Importance of High Voltages and HV tests; general requirements of HV testing ,testing of internal and external insulation systems. Generation of High alternating, direct and impulse voltages; measurements of alternating direct and impulse voltages and dielectric loss.Insulating materials: solids, liquids and gases; their electrical properties and applications; breakdown mechanisms in solid, liquid and gaseous dielectric; measurement of Radio interference Voltage (RIV) and partial discharges; generation and Measurement of impulse currents.

Power Electronics: Semiconductor Devices in switched mode - Diode, SCR, BJT, IGBT, MOSFET - drivers, protection, thermal aspects – ratings Figures of merit - ripple factor, average value, Harmonic factor, Distortion factor, THD, Power factor, Crest factor Power in switching circuits - 2-pulse Midpoint converter - analysis for R load, infinite inductive load, R-L load - implications of commutation overlap - use in DC drives. 3-pulse converter - analysis for R load, infinite inductive load, R-L load - implications of commutation overlap - use in DC drives. Bridge converters - three phase and single phase - analysis for R load, infinite inductive load, R-L load - implications of commutation overlap - use in DC drives. Buck, Boost, Buck-Boost and Cuk Converters - circuit steady state analysis - current and voltage ripple estimation - discontinuous and continuous modes of operation. Use of SCR in buck converters - commutation circuit. Inverters - 120 deg. and 180 deg. conduction operation – selective harmonic elimination - McMurray inverter - SPWM, unipolar and bipolar switching Single phase AC Voltage Controller - analysis and operation Snubbers - turn on, turn off, snubbers - RCD snubber Power Electronic Converters, Vector Control/Direct control /Torque Control of Motors, Simulation of PE systems, DSP Applications, Permanent Magnet

27/7/21

Machines and Special Machines.

Control Systems & Instrumentation: 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, Principles of feedback, transfer function, block diagrams, steady -state errors, Routh and Niquist techniques, Bode plots, root loci,lag, lead and lead-lag compensation, state space model, state transition matrix, controllability and observability, Bridges and potentiometers, PMMC, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, digital voltmeters and multimeters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis.

Analog and Digital Electronics: Characteristics of diodes, BJT, FET, amplifiers -biasing, equivalent circuit and frequency response, oscillators and feedback amplifiers, operational amplifiers-characteristics and applications, simple active filters, VCOs and timers,combinationaland sequential logic circuits, multiplexer, Schmitt trigger, multi-vibrators, sample and hold circuits,A/D and D/A converters, 8-bitmicroprocessor basics, architecture, programming and interfacing. Semiconductor power diodes, transistors, hyristors, triacs, GTOs, MOSFETs and IGBTs,Converter.

ELECTRONICS & TELECOMMUNICATION ENGG

Module-1 Linear Wave Shaping Circuits, Hall effects, Rectifiers, Clippers, Clampers, Semiconductor technology, Small Signals Modeling of BJT, MOSFETs, Feedback Amplifiers & Oscillators, OP-Amps, Current Source Circuits, BJT and JFET Frequency Response, Power Amplifiers(A, B, C types), Distortion analysis, Push-pull configuration, Transients, Resonance, Network theorems, Network Functions: Poles And Zeros, Stability of Networks, Two-Port Parameters, Positive Real Function, Driving-Point Synthesis With LC Elements, Two Terminal-Pair Synthesis By Lader Development Gate level Minimization, K Map, POS, SOP, Combinational Circuits, Sequential Circuits, Memory & Programmable Logic, Digital Integrated logic Circuits, State machine Active filter design, Instrumentation Amplifier, Wideband amplifiers, BistableMultivibrator, Schmitt trigger Circuit, MonostableMultivibrator, Tunnel diode & UJT, VCO, PLL Spectral Analysis, Power Spectral Density, AM, DSB-SC, SSB-SCand VSB, M, PM, Preemphasis and Deemphasis, Noise in AM & FM

Module-II Anti-aliasing Filter, PAM, PWM, PPM, PCM, DPCM, DM, ADM, Line Coding, ISI, Equalizer, Eye diagram, Timing Jitter, White Noise, BPSK, BFSK, DE-PSK, QPSK, MSK, M-ary PSK, M-ary FSK Co-ordinate transformation, Electrostatics, Magnetostatics, Steady Electric Currents, Maxwall's Equations, Helmholtz wave equation. Plane wave solution, Polarization of EM wave, Radio Wave Propagation CMOS p-Well and n-Well Processes, CMOS Inverter, Layout of an Inverter, Combinational & Sequential Logic Circuits in VLSI, Semiconductor Memories, Design Capture Tools, VHDL, Testing and Verification LTI System, z-transform DFT, IDFT, FFT,DIT & DIF algorithms, Convolution, Correlation, FIR & IIR FiltersIntel 8085 Microprocessor, Memory Interfacing, Stack &Subroutines, Interrupts,8253, 8255, 8257, 8259, Intel 8086, Intel 80386 and 80486

Module-III DC & AC bridges, True- RMS responding meter, Storage Oscilloscope, Sampling Oscilloscope, Sweep frequency Generator, Spectrum Analyzer, Strain Gages, Displacement Transducers, Instrumentation Amplifier, Isolation Amplifier, IEEE-488 GPIB Bus High

27/7/24

Frequency Transmission line and Wave guides, Smith chart, Field solution for TE and TM modes, Cylindrical waveguides, Microwave Resonator, Power divider and Directional Couplers, Reflex Klystron, Multi-Cavity Magnetron, Microwave Propagation 8051 Microcontroller, Arithmetic Instructions and Programs, Single- Bit Instructions And Programming, Interfacing of 8051

Module-IV Optical Fiber Modes and Configurations, Attenuation and Distortion in optical Fibers, LED and LASER Diodes, Optical Fiber System Link Budget Satellite Orbits, Spacing and Frequency Allocation, Satellite Sub-systems, Satellite System Link Models, Direct Broadcast Satellite Services, Application of LEO, MEO and GEO Satellites Image Digitization, Image Enhancement, Restoration, Compression,Segmentation, Processing of color images Methods for Speech Processing, Digital Representation of speech Waveform, Linear Predictive Speech Coding Block codes, Waveform coding, Cyclic Codes, Convolutional Encoding, Fuzzy Logic , Neural Networks, Evolutionary Computing Radar Equation, Radar Block Diagram, Radar Frequencies, Applications and Limitations of Radar TV Transmitters & its Block Diagram, Resolution, Scanning, Resolution, Sync Signal Cellular Concept & System Design, Mobile Radio Propagation, DS-SS and FHSS, GSM, CDMA Antenna Basics & Fundamentals, Horn Antenna, Aperture Antenna, Dipole antenna, Yagi antenna.

COMPUTER SCIENCE & ENGINEERING

Digital Logic: Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point). Computer Organization and Architecture: Machine instructions and addressing modes, ALU and datapath, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Programming and Data Structures: Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary Algorithms: Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and- conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes – P, NP, NP-hard, NP-complete.

Theory of Computation: Regular languages and finite automata, Context free languages and Pushdown automata, Recursively enumerable sets and Turing machines, Undecidability. Compiler Design: Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

Operating System: Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems,

27/7/21

Protection and security. Databases: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Information Systems and Software Engineering: information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

Computer Networks: ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security – basic concepts of public key and private key cryptography, digital signature, firewalls.

Web technologies: HTML, XML, basic concepts

INFORMATION TECHNOLOGY

Engineering Mathematics
Discrete Mathematics: Propositional and first order logic.Sets, relations, functions, partial orders and lattices.Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.
Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition. **Calculus:** Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.
Probability: Random variables. Uniform, normal, exponential, poisson and binomial distributions.Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.
Digital Logic
Boolean algebra.Combinational and sequential circuits.Minimization.Number representations and
computer arithmetic (fixed and floating point).
Computer Organization and Architecture
Machine instructions and addressing modes.ALU, data-path and control unit.Instruction pipelining.
Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).
Programming and Data Structures
Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.
Algorithms
Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design
techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.
Theory of Computation

27/7/14

Regular expressions and finite automata.Context-free grammars and push-down automata.Regular and contex-free languages, pumping lemma.Turing machines and undecidability.

Compiler Design

Lexical analysis, parsing, syntax-directed translation.Runtimeenvironments.Intermediate code generation.

Operating System

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

Databases

ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms.File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Computer Networks

Concept of layering.LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security:authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

PRODUCTION ENGINEERING

Metal Casting:It include topics- Casting processes – applications and types; patterns – materials and types; allowances;cores and moulds – materials, making and testing; casting techniques of cast iron, steels and nonferrous alloys and metals; solidification; design of casting, risering and gating; casting inspection, remedies and defects.

Metal Forming: Stress-strain relations in plastic and elastic deformation; concept of flow stress,deformationmechanisms;cold and hot working – forging, extrusion,rolling, wire and tube drawing;sheet metal working processes such as piercing,blanking, bending, deep drawing,embossingandcoining; analysis of rolling, extrusion,forging and rod/wire drawing; metal working defects.

Metal Joining Processes:manual metal arc,TIG,MIG, plasma arc, submerged arc, thermit, electro slag,resistance,friction, forge and explosive welding;other joining processes – soldering, braze welding,brazing; inspection of welded joints, remedies and decfects; introduction to advanced welding processes– ultrasonic, laser beam; electron beam ;thermal cutting.

Machining and Machine Tool Operations: Basic machine tools; machining processes-turning,drilling, milling,boring, planing,shaping, gear cutting, broaching, thread production,grinding, lapping,honing, super finishing; mechanics of machining – geometry of cutting tools,cutting forces, chipformation and power requirements, selection of machining parameters; Merchant's analysis; toolmaterials, tool life and tool wire, economics of machining, thermal aspects of machining, machinability,cutting fluids; principles and applications of nontraditional machining processes – AJM,USM,EDM,WJM and Wire cut LBM, EDM,EBM, CHM,PAM, ECM.

Tool Engineering:fixtures and jigs – applications,principles and design; press tools – configuration, design of punch anddie; principles of forging die design.

Metrology and Inspection: Fits,Limits and tolerances, selective assembly, interchangeability; linearand angular measurements by optical and mechanical methods, comparators; design of limit gauges;measurement of straightness, flatness, squareness ,

27/7/24

roundness and symmetry; surface finishmeasurement; inspection of gears and screw threads; alignment testing of machine tools.

Polymers and Composites: Introduction to composites and polymers; plastic processing – injection,blowmolding and Compression, extrusion, calendaring and thermoforming; molding of composites.

Manufacturing Analysis: Sources of errors in manufacturing; tolerance analysis in manufacturing andassembly; process capability; process planning; comparison of production alternatives and parameterselection, time and cost analysis; manufacturing technologies – selection and strategies.

Computer Integrated Manufacturing:Basic concepts of CAM,CAD, CAPP, cellular manufacturing,NC, DNC,CNC, Robotics, CIM and FMS.OperationResearch:Linear programming – problem formulation, duality, simplex method andsensitivity analysis; assignment and transportaion models; constrained optimization and Lagrangemultipliers; network flow models ,simple queuing models; dynamic programming; simulation – manufacturing applications;CPM and PERT, resource leveling, time-cost trade-off.Quality Assurance and Reliabilitycosts and concepts, quality assurance; quality circles, statisticalquality control, zero defects, acceptance sampling, total quality management, six sigma; ISO 9000;design of experiments – Taguchi method.vailability,Reliabilityand maintainability; distribution of failure and repair times; determination of MTTR and MTBF, system reliability determination; reliabilitymodels; preventive maintenance and replacement, total productive maintenance – applications andconcepts.

CHEMICAL ENGG.

Section 1: Engineering Mathematics

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

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

Differentialequations:Firstorderequations(linearandnonlinear),Higherorderlinear differentia l equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplacetransforms, Solutions of one dimensional heat and wave equations and Laplaceequation.

Complex variables: Complex number, polar form of complex number, triangle inequality.

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

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

Section 2: Process Calculations and Thermodynamics

Steady and unsteady state mass and energy balances including multiphase, multi-component, reacting and non -reacting systems. Use of tie components; recycle, bypass and purge calculations;Gibb'sphaserule and degree of freedomanalysis. First and Second laws of thermodynamics.Applications of first law to close and open systems.Second law and Entropy. Thermodynamic properties of pure substances:

27/7/21

Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

Section 3: Fluid Mechanics and Mechanical Operations

Fluid statics, Newtonian and non- Newtonian fluids, shell–balances including differential form of Bernoulli equation and energy balance,Macroscopicfriction factors, dimensional analysis and similitude, flow through pipeline systems, flow meters,pumpsandcompressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds, Turbulent flow: fluctuating velocity, universal velocity profile and pressuredrop.

Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids.

Section 4: Heat Transfer

Steady and unsteady heat conduction, convectionandradiation, thermal boundary layer and heat transfercoefficients, boiling, condensationandevaporation; types of heat exchangers and evaporators and their process calculations. Design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.

Section 5: Mass Transfer

Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wiseandcontinuouscontactingandstageefficiencies;HTU&NTUconcepts; Design and operation of equipment for distillation, absorption, leaching, liquid -liquid extraction, drying, humidification, dehumidification and adsorption.

Section 6: Chemical Reaction Engineering

Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in idealreactors,non-ideal reactors; residence time distribution,single parameter model; non-isothermal reactors; kineticsofheterogeneous, catalytic reactions; diffusion effects incatalysis.

Section 7: Instrumentation and Process Control

Measurement of process variables; sensors, transducers and their dynamics, process modeling and linearization, transfer functions and dynamicresponsesofvarious systems,systemswithinverseresponse,processreactioncurve,controllermodes(P,PI, and PID); control valves; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.

Section 8: Plant Design and Economics

Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizingofchemicalengineering equipmentssuchas compressors, heat exchangers, multistagecontactors.

Section 9: Chemical Technology

Inorganic chemical industries (sulfuric acid, phosphoricacid,chlor-alkaliindustry), fertilizers(Ammonia,Urea,SSPandTSP);naturalproductsindustries(PulpandPaper,Sugar , Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers).

Metallurgical& Materials Engineering

27/7/24

Structure: Atomic structure and bonding in materials. Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals by x-ray diffraction, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials.Crystal growth techniques. Imperfections in crystalline solids and their role in influencing various properties

Diffusion: Fick's laws and application of diffusion in sintering, doping of semiconductors and surface hardening of metals. Metals and Alloys: Solid solutions, solubility limit, phase rule, binary phase diagrams, intermediate phases, intermetallic compounds, iron-iron carbide phase diagram, heat treatment of steels, cold, hot working of metals, recovery, recrystallization and grain growth. Microstructure, properties and applications of ferrous and non-ferrous alloys

Ceramics: Structure, properties, processing and applications of traditional and advanced ceramics.

Polymers: Classification, polymerization, structure and properties, additives for polymer products, processing and applications.

Composites: Properties and applications of various composites.

Advanced Materials and Tools: Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials – synthesis, properties and applications, biomaterials, superalloys, shape memory alloys. Materials characterization techniques such as, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, scanning tunnelling microscopy, atomic absorption spectroscopy, differential scanning calorimetry

Mechanical Properties: stress-strain diagrams of metallic, ceramic and polymeric materials, modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, viscoelasticity, hardness, impact strength, creep, fatigue, ductile and brittle fracture.

Thermal Properties: Heat capacity, thermal conductivity, thermal expansion of materials.

Electronic Properties: Concept of energy band diagram for materials – conductors, semiconductors and insulators, electrical conductivity – effect of temperature on conductivity, intrinsic and extrinsic semiconductors, dielectric properties.

Optical Properties: Reflection, refraction, absorption and transmission of electromagnetic radiation in solids.

Magnetic Properties: Origin of magnetism in metallic and ceramic materials, paramagnetism, diamagnetism, anti-ferro magnetism, ferromagnetism, ferrimagnetism, magnetic hysteresis. Environmental Degradation: Corrosion and oxidation of materials, prevention.

PHYSICS

Mathematical Physics: Linear vector space; matrices; vector calculus; linear differential equations;elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about tensors.

27/7/24

Classical Mechanics: Conservation laws; central forces, Kepler problem and planetary motion;collisions and scattering in laboratory and centre of mass frames; mechanics of system of particles; rigidbody dynamics; moment of inertia tensor; noninertial frames and pseudo forces; variationalprinciple;Lagrange's and Hamilton's formalisms; equation of motion, cyclic coordinates, Poisson bracket;periodic motion, small oscillations, normal modes; special theory of relativity – Lorentz transformations,relativistic kinematics, mass-energy equivalence.

Electromagnetic Theory: Solution of electrostatic and magnetostatic problems including boundaryvalue problems; dielectrics and conductors; Biot-Savart's and Ampere's laws; Faraday's law; Maxwell'sequations; scalar and vector potentials; Coulomb and Lorentz gauges; Electromagnetic waves and theirreflection, refraction, interference, diffraction and polarization. Poynting vector, Poyntingtheorem,energy and momentum of electromagnetic waves; radiation from a moving charg.

Quantum Mechanics: Physical basis of quantum mechanics; uncertainty principle; Schrodingerequation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory.

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

Atomic and Molecular Physics: Spectra of one- and many-electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; X-ray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR; lasers.

Solid State Physics: Elements of crystallography; diffraction methods for structure determination; bonding in solids; elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids; metals, semiconductors and insulators; transport properties; optical, dielectric and magnetic properties of solids; elements of superconductivity.

Nuclear and Particle Physics: Nuclear radii and charge distributions, nuclear binding energy, Electric and magnetic moments; nuclear models, liquid drop model – semi-empirical mass formula, Fermi gas model of nucleus, nuclear shell model; nuclear force and two nucleon problem; Alpha decay, Betadecay, electromagnetic transitions in nuclei; Rutherford scattering, nuclear reactions, conservation laws; fission and fusion; particle accelerators and detectors; elementary particles, photons, baryons, mesons and leptons; quark model.

Electronics: Network analysis; semiconductor devices; Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits; operational amplifier, negative feedback circuits ,active filters and oscillators; rectifier circuits, regulated power supplies; basic digital logic circuits, sequential circuits.

CHEMISTRY

PHYSICAL CHEMISTRY

Structure: Quantum theory: principles and techniques; applications to a particle in a box,harmonic oscillator, rigid rotor and hydrogen atom; valence bond and molecular orbital theories,Hückel approximation; approximate techniques: variation and perturbation; symmetry, point groups; rotational, vibrational, electronic, NMR, and ESR spectroscopy

Equilibrium: Kinetic theory of gases; First law of thermodynamics, heat, energy, and work; second law of thermodynamics and entropy; third law and absolute entropy; free energy;

Sopanda 27/7/24

partial molar quantities; ideal and non-ideal solutions; phase transformation: phase rule and phase diagrams – one, two, and three component systems; activity, activity coefficient, fugacity, and fugacity coefficient; chemical equilibrium, response of chemical equilibrium to temperature and pressure; colligative properties;

Kinetics: Rates of chemical reactions, temperature dependence of chemical reactions; elementary, consecutive, and parallel reactions; steady state approximation; theories of reaction rates – collision and transition state theory, relaxation kinetics, kinetics of photochemical reactions and free radical polymerization, homogeneous catalysis, adsorption isotherms and heterogeneous catalysis.

INORGANIC CHEMISTRY

Main group elements: General characteristics, allotropes, structure and reactions of simple and industrially important compounds: boranes, carboranes, silicones, silicates, boron nitride, borazines and phosphazenes. Hydrides, oxides and oxoacids of pnictogens (N, P), chalcogens (S, Se &Te) and halogens, xenon compounds, pseudo halogens and interhalogencompounds.Shapes of molecules and hard- soft acid base concept.

Transition Elements: General characteristics of d and f block elements; coordination chemistry: structure and isomerism, stability, theories of metal- ligand bonding (CFT and LFT), mechanisms of substitution and electron transfer reactions of coordination complexes. Electronic spectra and magnetic properties of transition metal complexes, lanthanides and actinides.

Instrumental methods of analysis: Atomic absorption and emission spectroscopy including ICP-AES, UV- visible spectrophotometry, NMR, mass, Mossbauer spectroscopy (Fe and Sn), ESR spectroscopy, chromatography including GC and HPLC and electro-analytical methods (Coulometry, cyclic voltammetry, polarography – amperometry, and ion selective electrodes).

ORGANIC CHEMISTRY

Stereochemistry: Chirality of organic molecules with or without chiral centres. Specification of configuration in compounds having one or more stereogeniccentres. Enantiotopic and diastereotopic atoms, groups and faces.Stereoselective and stereospecific synthesis.Conformational analysis of acyclic and cyclic compounds.Geometricalisomerism.Configurational and conformational effects on reactivity and selectivity/specificity.

Reaction mechanism: Methods of determining reaction mechanisms. Nucleophilic and electrophilic substitutions and additions to multiple bonds.Eliminationreactions.Reactive 30 intermediates- carbocations, carbanions, carbenes, nitrenes, arynes, free radicals.Molecular rearrangements involving electron deficient atoms.

Organic synthesis: Synthesis, reactions, mechanisms and selectivity involving the followingalkenes, alkynes, arenes, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Use of compounds of Mg, Li, Cu, B and Si in organic synthesis.Concepts in multistep synthesis- retrosynthetic analysis, disconnections, synthons, synthetic equivalents, reactivity umpolung, selectivity, protection and deprotection of functional groups.

Pericyclic reactions: Electrocyclic, cycloaddition and sigmatropic reactions. Orbital correlation, FMO and PMO treatments.

Photochemistry: Basic principles. Photochemistry of alkenes, carbonyl compounds, and arenes.Photooxidation and photoreduction.Di-π- methane rearrangement, Barton reaction.

Heterocyclic compounds: Structure, preparation, properties and reactions of furan, pyrrole,

27/7/21

thiophene, pyridine, indole and their derivatives.
Biomolecules: Structure, properties and reactions of mono- and di-saccharides, physicochemical properties of amino acids, chemical synthesis of peptides, structural features of proteins, nucleic acids, steroids, terpenoids, carotenoids, and alkaloids.
Spectroscopy: Principles and applications of UV-visible, IR, NMR and Mass spectrometry in the determination of structures of organic molecules.

MATHEMATICS

Real Analysis Axioms of Choice, Countability, Bolzano-Weiestrass theorem, Heine-Borel theorem, Convergence of sequences and series of real numbers, Tests of Convergence, Cauchy Test, Uniform continuity, Sequences and series of functions, Uniform convergence. Power series, Weiestrass approximation theorem, Differentiation, Reimann-Stieltjes Integration, Function of several variables, Differentiability, Inverse function theorem, Implicit function theorem, Constrained maxima and minima.
Complex Analysis Analytic functions, Power Series, Exponential and trigonometric functions, Conformal mapping, Riemann-Stieltjes integral, Power Series representation of Analytic functions, The index of a closed curve, Cauchy's theorem for rectangle, Cauchy theorem for disc, Cauchy's integral formula, Liouville's theorem, Fundamental theorem of Algebra, Morera's theorem, Open mapping theorem, Zeros, Poles, Classification of Singularities, Laurent Series, Residues, The Maximum Modulus theorem.
Functional Analysis Lp – spaces, Inequalities in Lp – spaces, Completeness of Lp, Normed linear spaces, inner product spaces examples, properties of Normed linear spaces and inner product spaces, Hilbert spaces, Examples, orthonormal sets, Gram-Schmidt orthonormalizations, Orthonormal polynomials, Orthonormal basis, Fourier Expansion, Hahn Banach Theorem, Baire's category theorem ,Open mapping Theorem ,Closed graph theorem, Uniform boundedness Principle.
Numerical Analysis Root finding for non-linear equations, Lagrange and Newton interpolations, Interpolating polynomials using finite differences, Hermite interpolation, Piecewise and Spline interpolation, Numerical differentiation, Numerical integration, Numerical Solution of system of linear equations, Numerical solution of ordinary differential equation.
Linear Algebra Vector spaces over fields, subspaces, bases and dimension, Systems of linear equations, matrices, rank, rank-nullity theorem, duality and transpose, Eigenvalues and eigenvectors, characteristic polynomials, minimal polynomials, Cayley-Hamilton Theorem, triangulation, diagonal-lization, rational canonical form, Jordan canonical form.
Modern Algebra Groups, Subgroups, Normal Subgroups, Quotient groups, Homomorphism, Isomorphism, Cyclic groups, Permutation groups, Symmetric groups, Cayley's Theorem, Sylow theorem, Application of Sylow Theorem, Free Abelian groups, Free Groups, Vector Spaces, Subspaces, Quotient spaces, Linear independence, bases, Dimension, Projection, Algebra of matrices, Rank of a matrix, Characteristic roots and Vectors, Matrix representation of a linear transformation.
Ordinary Differential Equation System of first order equations, Existence and Uniqueness theorems, Successive approximation Picard's Theorem, Non Uniqueness of solutions, Existence and uniqueness of solution of systems, Strum Liouville's Problem green's

27/7/21

functions, Picard's theorem.

Partial Differential Equation Classification of first order Partial differential equations, Pfaffian differential equations, Lagrange's method, Compatible systems, Charpit's method, Jacobi's method, Integral surfaces passing through a given curve, Monge cone, characteristic strip, Classification of Second order Partial Differential Equations., One dimensional Wave equation, Vibration of an infinite string, origin of the equation, D'Alembert's solution, Vibrations of a semi finite string, Vibrations of a string of finite length, Laplace equation , Boundary value problems, Maximum and minimum principles.

Measure Theory 32 Sigma Algebra of Sets, Borel sets of **R**, Lebesgue outer measure and its properties, Sigma Algebra of Measurable sets in **R** , Non-measurable sets, Lebesgue measure and its properties, Cantor set and its properties, Measurable functions, Simple functions, Integration of Nonnegative functions, Riemann and Lebesgue Integration, Monotone convergence theorem, Fatou's Lemma, and Dominated convergence theorem.

Topology Bases, Subbases, Countability, closed sets, Limit Points, Continuous functions, Subspace topology, Product topology, and Quotient topology, Connectedness, Local connectedness, Path-connectedness, compact Spaces, compactness in metric spaces, locally compacts spaces, Regular and completely regular space, normal spaces.

Discrete Mathematical Structures Permutation, Combination, Graphs: Basic terminology, Multi graph and Weighted graphs, Paths and circuits, Eulerian Paths and circuits, Hamiltonion Paths and circuits, Trees: Rooted trees, binary search trees, Spanning trees, Cut sets, Recurrence relations and recursive Algorithms, Boolean Algebras.

Linear Programming Simplex Method, Primal and Dual Problem, Duality & Simplex method, Dual Simplex Method, Transportation Problem, Properties of transportation matrix, N-W corner rule, Vogel's approximation method, and Transportation algorithm, Assignment Problem, Two person zero sum games, Maxmin and Minmax principle

ENGLISH

Concepts in Literature Literature: culture, context, convention, its practice and relevance Genres of literature: poetry, fiction, drama Literary devices and literary forms Ballad,Comedy,Elegy,Epic,Novel,Ode,Romance,Sonnet,Tragedy,Tragicomey, Short Story)

Classical and neo-classical critical theories Classical Theory & Criticism, Aristotle's Poetics, Longinus' On the Sublime Neoclassical theory and criticism Samuel Johnson's "Preface" to Plays of William Shakespeare

Literature and Social history-I Medieval Period: Feudalism and Role of the Church Early Modern: Humanism and the English Renaissance and the Print Revolution The Beginnings of Colonialism The Enlightenment: Ideas of the Enlightenment & The Beginnings of Modern Democracy Colonialism to Imperialism

The novel in 18th-19th Centuries Daniel Defoe's Moll Flanders Jane Austen's Persuasion Emily Brontë's Wuthering Heights Jonathan Swift's Gullive's Travels Richardson Pamela

Theory- Romantic & Victorian theory & Criticism Romantic Theory & Criticism Wordsworth's 'Preface' to Lyrical Ballads (Second Edition) Coleridge's BiographiaLiteraria (Chapter XIII) Victorian Theory & Criticism Arnold's "The Study of Poetry"

Modern Drama Introduction to Modern Drama, George Bernard Shaw's Pygmalion, Modern Drama and the Absurd, Samuel Beckett's Waiting for Godot, Harold Pinter's The Birthday

27/7/24

Party

Modern Poetry Poetry in the Modern World Yeats's "Sailing to Byzantium" Eliot's The Waste Land Auden's "In Memory of W.B.Yeats" William Carlos Williams' "Autumn and All"

20th Century Criticism New Criticism Literary Theory: A Composite View Structuralism to Post-structuralism Roland Barthes Psychoanalysis and Jacques Lacan Feminism

COMPUTER APPLICATIONS

(Syllabus for interview/test for admission to PhD programme in Computer Application) Following are the broad areas under which the candidate appearing for Ph.D. entrance test will be examined. Topics covered in the books following each subject area, upto the postgraduate level comprises the syllabus for this test. Alternate books, references which cover the same topics may be used instead. Candidates are expected to have basic proficiency in programming. No specific programming language for the test is expected.

Subjects:

Computer Architecture: representation of numbers; Octal, Hexadecimal, and Binary 2's complement and 1's complement arithmetic, Floating point representation. Combinational Circuit Design, Sequential Circuit Design, Hardware and Microprogrammed processor design, Instruction formats, Addressing modes, Memory types and organization, interfacing peripheral devices, Interrupts.

Data Structures & Algorithms: Arrays, stacks, queues, lists, linked, trees, graphs priority queues, heaps, Binary tree, AVL tree, B-tree and Hash tables. Graphs: connected graphs, regular and bipartite graphs, cycles and circuits. Tree and rooted tree. Spanning tree of a graph, Eccentricity of a vertex, radius and diameter of a graph. Hamiltonian, Eulerian graphs and Planar graphs. Sorting and Searching Algorithms, Binary Search, Analysis of Algorithms, Asymptotic notations – big oh, omega and theta.Average case analysis of simple programmes like finding of a maximum of n elements.Recursion and its systematic removal. Techniques for Designing Algorithms: Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound. NP-hard and NP-complete problems.

Programming language concepts and paradigms: Data types, Operators, expressions, Assignment. Flow of control-control structures, I/O statements, User-defined and built-in functions.Parameter passing. Language Design: Syntax and semantics of a programming language and related concepts. Programming Paradigm and related concepts: Imperative, Object-oriented. Functional Logic paradigms

Operating Systems Main functions of operating system, Multiprogramming multiprocessing and multitasking. Memory Management: Virtual memory, paging fragmentation. Concurrent Processing: Mutual exclusion. Critical regions, lock and unlock. Scheduling: CPU scheduling, I/O scheduling, Resource scheduling. Scheduling algorithms.Banker's algorithm for deadlock handling.

Database Concepts: ER diagrams, Data Models. Design of Relational Database, Normalisation, 1NF, 2NF, 3NF, BCNF and 4NF.Limitations of the normal forms. SQL and QBE, query Processing and Optimisation. Centralised and Distributed Database Security, Object Oriented Database Management Systems with RDBMS applications.

Computer Networks & Data Communication: Channel capacity. Transmission media twisted pair, coaxial cables, fibre-optic cables, wireless transmission–radio, microwave

27/7/24

infrared and millimeter waves. Light wave transmission. Telephone–local loop, unit multiplexing, switching, narrowband ISDN, broadband ISDN, ATM. High speed LANS Cellular Radio. Communication satellites– geosynchronous and low-orbit.Analog and Digital Transmission, Asynchronous and Synchronous transmission Transmission media, Multiplexing and Concentration, Switching techniques, Polling. Topologies, Networking Devices, OSI Reference Model: Protocols for – Data link layer Network layer, and Transport layer; TCP/IP protocols, Network security, Network administration.

Theory of computation: Models of computation: Deterministic Finite Automation (DFA), Nondeterministic Finite Automaton (NFA), Regular languages, Equivalences of DFA and NFA, Equivalence of DFA/NFA and regular languages, minimizing the number of states of DFA. Non-regular languages, and Pumping lemma. Context-free Grammars & Pushdown Automata (PDA): Deterministic Pushdown Automation (DPDA), Non-deterministic Pushdown Automation (NDPDA) Non-equivalence of DPDA and Non-deterministic Pushdown Automation (NDPDA). Context free grammar (CFG). Equivalence of PDA's ad CFG's: Ambiguity, Parse Representation of Derivations. Simplification of CFGs: Greibach Normal Form GNF 35 and Chomsky Normal Form (CNF). Parsing techniques for parsing of general CEG Cook-KassamiYounger (CKY) algorithm. Turing Machine (TM): One tape, multitape. The notions of time and space complexity in terms of TM, Construction of TM for simple problems.Computational complexity, Non-computability and Examples of non-computable problems. Hierarchy of languages: Grammars, Languages – types of grammars – type 0, type 1, type 2, type 3. The relationship between types of grammars, and finite machine Pushdown automation and Context Free Grammars.Lexical Analysis regular expressions and regular languages.Recursive and recursivelyenumerable languages.

Compiler Design: Compiler structure, compiler construction tools, compilation phases, Context free grammars. Paring and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Bottom up parser – shift – reduce, operator precedence, and LR. Topdown parsers – left recursion and its removal. Recursive descent parser, Predictive parser, Intermediate code generation, Code generation, Code optimisation.

Artificial Intelligence: Elements of Symbolic Logic: Propositional (Boolean) Logic, Predicate Logic, Well-formed-formulae (WFF), Deduction, Satsifiability and Tautology, Refutation method. Applications in problem solving.State space representation of problem. Search techniques: breadth-first, depth-first. A, A* Knowledge representation: Frames, scripts, semantic nets, production systems, Fuzzy Systems: Definition of a Fuzzy set, Fuzzy relation, Fuzzy function, Fuzzy reasoning Applications to problem solving.

Software Engineering: System Development Life Cycle (SDLC): Steps, Water fall model, Prototypes, Spiral model. Software Metrics: Software Project Management. Software Design: System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics. Coding and testing: Testing level metrics, Software quality and reliability, Clean room Approach, software reengineering.

27/7/21
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1. All HODs, for kind information and necessary action.
2. Dean, Academic Affairs / COE / COF / Registrar for kind information.
3. PA to Vice Chancellor for kind information of Hon'ble Vice-Chancellor.

27/7/14

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