



CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

छत्तीसगढ़ स्वामी विवेकानंद तकनीकी विश्वविद्यालय, भिलाई (छ.ग.)

Newai, P.O. Newai, Bhilai, Distt. Durg(Chhattisgarh) – 491107 Ph. No.:0788 – 2200062, Fax 0788-2445020,
Website: www.csvtu.ac.in, E-mail: registrar@csvtu.ac.in

Ref..No.CSVTU/Advt/2023/R-014

Date:07/07/2023

ADVERTISEMENT FOR FACULTY RECRUITMENT

Online Applications are invited from the prospective & eligible candidates for the post of **Assistant Professor** in the following departments: -

Assistant Professor: Level – 10 Entry Pay ₹57700/-

CATEGORY WISE DISTRIBUTION OF POSTS

Sl. No.	Department	Category wise No. of Vacancies				Total
		UR	SC	ST	OBC	
1	Environmental & Water Resource Engineering	2(1*)	---	1*	1	4
2	Energy & Environmental Engineering	2(1*)	1	1	---	4
3	Structural-Engineering	2	---	1	1	4
4	Biomedical Engineering & Bioinformatics	1*	1	2(1*)	---	4
5	M. Plan	1	---	---	---	1
6	Microelectronics & VLSI	---	---	---	1*	1
Total:-		8	2	5	3	18
* stands for post reserved for FEMALE						

Information about Vacant positions, Essential qualifications, Experience, Age limit, Detail schedule & other details are also available in official web site <https://csvtu.ac.in/ew/recruitment-2/>

- **Application process:** Application forms can be submitted online through University website under <https://csvtu.ac.in/ew/recruitment-2/> User manual for application form submission is available in University website.
- **Timelines:**
 - (a) Online application facility will be available from **11/07/2023, 05:00 p.m. to 27/07/2023, 05:00 p.m.**
 - (b) Printout/Hard copy of application forms with self-attested copies of all documents in support of application (academic/ research performance/ academic credentials/ accomplishments/other relevant annexures) must reach to University through registered /speed post only on or before **06/08/2023, 05:30 p.m.**
- **Online Application Fee:** Nonrefundable fee of ₹2500/- (₹1500/- for SC/ST/PWD candidates of CG Domicile) is to be paid during online form submission, for processing of applications.
- **Written test/Interview for shortlisted candidates:** The schedule of written test/Interview will be notified in University website. The list of candidates qualified for personal interview will also be published in the University website. The syllabus for written test is enclosed with this advertisement for reference. No individual communication will be done to the candidates. No request for postponement of the date of interview would be entertained. Mere eligibility will not entitle any candidate for being shortlisted. University may shortlist the application forms for interview on the basis of written test/good academic record.

Details of Minimum Eligibility & Other information

Cadre	Discipline/ Programme	Minimum qualification, experience, research contributions
Assistant Professor	Engineering / Technology	B. E. / B. Tech. / B. S. and M. E. / M. Tech. / M. S. or Integrated M. Tech. in relevant branch with first class or equivalent in anyone of the degrees.
Assistant Professor	Architecture & planning	First class Bachelor's Degree in Architecture OR Bachelor's Degree in Architecture AND First class M.Arch. or equivalent.

➤ **Eligibility of direct Ph.D. after B.E./ B.Tech**

The qualification of Ph.D acquired for the various level of posts directly after B.E/ B.Tech. is applicable, provided degree of Ph. D awarded is in relevant discipline by a recognized University following the process of registration, course work and evaluation etc. as prescribed by UGC or has been awarded by the Institutes of national importance (i.e. IITs/IISc/ NITs etc.), duly recognized by the MoE (Ministry of Education). Further, candidate should have obtained at least first class at Bachelor's level in Engineering /Technology.

➤ **Class / Division**

If a class / division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class / division. If a Grade Point System is adopted the CGPA will be converted into equivalent marks as below.

Grade Point	Equivalent Percentage
6.25	55%
6.75	60 %
7.25	65 %
7.75	70 %
8.25	75 %

(Reference from All India Council for Technical Education, Notification, New Delhi dated 1st March, 2019, clause 7.3)

➤ **Research Publications**

In order to ensure quality of publications for recruitment, a minimum standard would be ensured through the following.

For the purpose of recruitment, candidates must have published research papers in SCI journals OR UGC approved Journals OR AICTE approved list of journals OR jointly approved by AICTE with respective councils / institute such as Council of Architecture / Institute of Town Planners, India.

➤ **Nomenclature of relevant degrees**

Subject to notification of Government of India Gazette F.No. 27/RIFD/Pay/01/2017-18, dated 28.04.2017.

➤ **Age Limit**

The age limit of the applicants will be calculated as on date of 01/01/2023 from the date of birth. Age limit for the posts is given below.

Name of Post	Minimum Age Limit	Maximum Age Limit
Assistant Professor	21 Years	40 Years

Note: There will be age relaxation of five years for the candidates possessing Ph.D. degree applying for the post of Assistant Professor, as per Ordinance of University.

[Signature]

Relaxation in maximum age limit for the domiciled candidates of Chhattisgarh State will be applicable as per the directives issued by Government of Chhattisgarh on time-to-time basis. However, no relaxation beyond 45 years of age will be considered as per the directive issued by the Government of Chhattisgarh.

- **Reservation:** Reservation will be provided to the domiciled candidates of Chhattisgarh as per the norms of Government of Chhattisgarh. The applicants belonging to reserved category should produce the caste certificate issued by the competent authority of Government of Chhattisgarh, complimented with income certificate if the caste certificate is issued before three years.
- **Selection Procedure:**
 - a) Selection will be based on the performance of written test/academic record assessment/interview as decided by the University.
 - b) The schedule of Interview will be notified on University website along with the list of shortlisted candidates invited for personal interview. University may shortlist the application forms for interview on the basis of written test/good academic record.
 - c) The candidates invited for interview, must comply with the instructions given in the Interview call letter for appearance and must bring his/her original certificates in respect of academic/ research performance/ academic credentials/ accomplishments /NOCs from appointee/ date of birth/ relevant experience/ Aadhar card/PAN card and other relevant annexures. Candidates coming without original certificates will not be permitted for appearing in the interview.
- **General Terms & Conditions:**
 1. Application forms submitted online through CSVTU website only, will be accepted. The application will not be considered, if the candidate does not upload the appropriate documents clearly as given in Online application form. (Before uploading please make sure that the documents are clearly visible and are in appropriate format).
 2. The University reserves the right not to fill up any of the vacancies advertised if the circumstances so warrant. Any consequential vacancies arising at the time of interview may also be filled up from the available candidates. The number of positions is thus open to change.
 3. In case of any inadvertent mistake in the process of selection, which may be detected at any stage even after the issue of appointment letter, the University reserves the right to modify/withdraw/cancel any communication made to the candidates.
 4. In case of any dispute/ambiguity that may occur in the process of selection, the decision of the University shall be final.
 5. Candidates are advised to satisfy themselves before applying that they possess at least the minimum essential qualifications laid down in the advertisement. The entire onus of the content/authenticity of the information being uploaded in the form of application and its attachments shall exclusively rest with the applicant in terms of eligibility for recruitment and for subsequent selection through due process.
 6. The University shall, in no way, be responsible for any error/omission/commission/ suppression of relevant information by the applicant knowingly/ unknowingly/ overtly/ covertly while filling up the application form and uploading the documents required therein.
 7. The prescribed qualifications will be minimum and the mere fact that a candidate possessing the same will not entitle him for being called for interview.



8. The University will have the right to restrict the number of candidates and shortlist most suitable candidates to be called for interview to a reasonable number, on the basis of written test performance/ good academic record or by any other condition that may deem fit.
9. The University will not be responsible for delay in submission of application forms of the candidates. The late submitted applications will not be considered and rejected in the further process of recruitment.
10. Applicants who are in employment must send the No Objection certificate from appointee along with hard copy of Application form to the University, as per the timeline notified.
11. The application submitted without required certificates will be rejected and no communication will be entertained to that effect.
12. Number of posts indicated are tentative and may increase or decrease as per the requirement of the University at the time of Interview / Appointment. The University will have the right to restrict the number of candidates to be called for interview.
13. No TA/DA will be admissible to the candidates for appearing in the interview.
14. If any information submitted by the candidate in application form is found inconsistent or inaccurate, appropriate action shall be initiated against the candidate and such application will be rejected.
15. In case the applicant gets screened/selected/appointed on the basis of the credentials furnished by him/her which are on scrutiny, found to be incorrect / inadmissible/ forged/ fabricated/ falsified, his/her candidature shall be liable to be cancelled at any stage of the recruitment/at any time during the tenure of the service and appropriate legal action under applicable law shall be initiated against the applicant.
16. The University reserves the right to modify/withdraw/cancel any communication made to the applicant. In case of any dispute arising out of such a situation, the decision of the University shall be final and binding on the applicant.
17. Canvassing in any form and/or bringing in any influence political or otherwise will be treated as disqualification for the post.
18. No interim enquiries/correspondence/communication of any sort will be entertained on the matter.
19. The hard copy/printout of the application form with self-attested copies of all documents in support of application (academic/ research performance/ academic credentials/ accomplishments /NOCs/ other relevant annexures) must be sent to University. Applications received, if incomplete in any respect and not accompanied by relevant certificates/documents/ photograph/ required fee will be rejected.
20. Eligibility of a candidate and satisfaction of any other shortlisting criteria will be considered as on the last date of the submission of Online application form.
21. With reference to letter of Finance Department Government of Chhattisgarh क्र372/260/वि./न/चार/2020 नवा रायपुर, अटल नगर दिनांक 29/07/2020 एवं संशोधन पत्र क्रमांक367/वित्त/नियम/चार/2020 नवा रायपुर, अटल नगर दिनांक 28/07/2020 के अनुसार the candidates selected through this advertisement will be in probation period of three years from the date of appointment and will be paid the stipend as mention below :-

First Year	-	70% of the Entry Pay
Second Year	-	80% of the Entry Pay
Third Year	-	90% of the Entry Pay

Provided that during probation period, other allowances along with stipend shall be received.



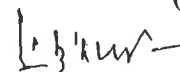
22. The University reserves the right to revise/reschedule/cancel/suspend the recruitment process without assigning any reason. The decision of the University shall be final and no appeals shall be entertained.
23. Any change or amendment in this advertisement shall be displayed on the University website only, therefore the aspiring candidates are advised to visit University website regularly and remain updated.
24. The terms & conditions of service of the candidates selected through this advertisement will be governed by the Act of CSVTU, Bhilai and Government of Chhattisgarh, enacted time to time.
25. The Chairman Selection Committee shall have the power to lay-down the procedure in respect of any matter not mentioned ABOVE.
26. With reference to the letter of General Administration Department Government of Chhattisgarh, क्र. एफ 13-1 /2023/आ.प्र./1-3, नवा रायपुर दिनांक 03/05/2023. this recruitment will be subject to the final outcome of proceedings of Honorable Supreme Court New Delhi S.L.P(C) No.19668/2022.

Important Note:-

1. All the candidates should submit their Online applications on or before from **27/07/2023, 05: 00 p.m.** and thereafter send the hard copy/printout of the same with self-attested copies of all documents in support of application (academic/ research performance/ academic credentials/ accomplishments /NOCs/ other relevant annexures) in an envelope, which must reach through Registered/Speed post at University on or before **06/08/2023, 05:30 p.m.** at the address mentioned below: -

To,
The Registrar,
(Recruitment Cell)
Chhattisgarh Swami Vivekanand Technical University,
Newai, Bhilai, Distt-Durg (C.G.) 491107
2. "Application No..... for the post ofin the department ofvide advertisement number dated....." must be written on the envelope.
3. *Candidates are advised to visit the University website regularly for further information/update.*

(REGISTRAR)



**SYLLABUS OF VARIOUS DISCIPLINES
FOR WRITTEN TEST FOR THE POST OF ASSISTANT PROFESSOR**

General Information: -

1. Written test will be of objective type (Multiple Choice Questions).
2. 100 questions with four choices will be asked in the test.
3. Duration of test will be 02 hours.
4. 04 marks for each correct answer will be awarded to candidate.
5. There will be negative marking for wrong answer. 02 marks will be deducted for every wrong answer attempted.
6. Date, Time & Centre of Exam will be mentioned in Admit Card.

BIOMEDICAL ENGINEERING & BIO INFORMATICS

Electrical Circuits:

Voltage and Current Sources - independent, dependent, ideal and practical; v-i relationships of resistor, inductor and capacitor; transient analysis of RLC circuits with dc excitation; Kirchoff's laws, superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems; Peak, average and rms values of ac quantities; apparent, active and reactive powers; phasor analysis, impedance and admittance; series and parallel resonance, realization of basic filters with R, L and C elements, Bode plot.

Signals and Systems:

Continuous and Discrete Signal and Systems - Periodic, aperiodic and impulse signals; Sampling theorem; Laplace and Fourier transforms; impulse response of systems; transfer function, frequency response of first and second order linear time invariant systems, convolution, correlation. Discrete time systems - impulse response, frequency response, DFT, Z - transform; basics of IIR and FIR filter.

Analog and Digital Electronics:

Basic characteristics and applications of diode, BJT and MOSFET; Characteristics and applications of operational amplifiers - difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier, buffer, filters and waveform generators. Number systems, Boolean algebra; combinational logic circuits - arithmetic circuits, comparators, Schmitt trigger, encoder/decoder, MUX/DEMUX, multi-vibrators; Sequential circuits - latches and flip flops, state diagrams, shift registers and counters; Principles of ADC and DAC; Microprocessor- architecture, interfacing memory and input- output devices.

Measurements and Control Systems:

SI units, systematic and random errors in measurement, expression of uncertainty -accuracy and precision index, propagation of errors; PMMC, MI and dynamometer type instruments; dc potentiometer; bridges for measurement of R, L and C, Q-meter. Basics of control system - transfer function.

Sensors and Bioinstrumentation:

Sensors - resistive, capacitive, inductive, piezoelectric, Hall effect, electro chemical, optical; Sensor signal conditioning circuits; application of LASER in sensing and therapy. Origin of bio potentials and their measurement techniques - ECG, EEG, EMG, ERG, EOG, GSR, PCG, Principles of measuring blood pressure, body temperature, volume and flow in arteries, veins and tissues, respiratory measurements and cardiac output measurement. Operating principle of medical equipment- sphygmomanometer, ventilator, cardiac pacemaker, defibrillator, pulse oximeter, hemodialyzer Electrical Isolation (optical and electrical) and Safety of Biomedical Instruments.

Human Anatomy and Physiology:

Basics of cell, types of tissues and organ systems; Homeostasis; Basics of organ systems - musculoskeletal, respiratory, circulatory, excretory, endocrine, nervous, gastro-intestinal and reproductive.

Medical Imaging Systems:

Basic physics, Instrumentation and image formation techniques in medical imaging modalities such as X-Ray, Computed Tomography, Single Photon Emission Computed Tomography, Positron Emission Tomography, Magnetic Resonance Imaging, Ultrasound.

Biomechanics:

Kinematics of muscles and joints - free-body diagrams and equilibrium, forces and stresses in joints, biomechanical analysis of joints, Gait analysis; Hard Tissues - Definition of Stress and Strain, Deformation Mechanics, structure and mechanical properties of bone - cortical and cancellous bones; Soft Tissues - Structure, functions, material properties, viscoelastic properties, Maxwell & Voight models; Biofluid mechanics - Flow properties of blood in the intact human cardiovascular system.

Biomaterials:

Basic properties of biomaterials - Metallic, Ceramic, Polymeric and Composite; Fundamental characteristics of implants - biocompatibility, bioactivity, biodegradability; Basics of drug delivery; Basics of tissue engineering. Biomaterial characterization techniques - Rheology, Atomic Force Microscopy, Electron Microscopy, Transmission Electron Microscopy Fourier Transform Infrared Spectroscopy.

ENVIRONMENTAL & WATER RESOURCE ENGINEERING

Section 1: Environmental Chemistry

Fundamentals of Environmental Chemistry: Covalent and ionic bonding; Chemical equations, concentration and activity; Structure and chemistry of organic molecules; Radioactivity of elements; Chemical equilibria; Thermodynamics and kinetics of chemical reactions.

Principles of Water Chemistry: Water quality parameters and their measurement; Acid-base equilibria; Buffer solution; Carbonate system; Solubility of gases in water; Complexation, precipitation, and redox reactions; Inorganic and organic contaminants in water and their speciation.

Soil Chemistry: Organic matter, nitrogen, phosphorous, potassium, cation exchange capacity, base saturation, and sodium absorption ratio.

Atmospheric Chemistry: Composition of the atmosphere; Reactivity of trace substances in the atmosphere; Urban atmosphere—smog and particulate pollution; Chemistry of ozone formation; Chemistry of stratosphere.

Section 2: Environmental Microbiology

Prokaryotic and Eukaryotic Microorganisms; Characteristics of diverse groups of microorganisms; Classification of microorganisms; Microbial diversity; Plant-microbe and soil-microbe interactions; Role of microorganisms in wastewater treatment, bioremediation and biogeochemical cycling.

Cell Chemistry and Cell Biology: Structure of proteins, nucleic acid (DNA & RNA), lipids and polysaccharides; Bonds in biomolecules; Stereoisomerism in biomolecules; Structure of cell; Structure and function of cytoplasmic membrane, cell wall, outer membrane, glycocalyx, chromosomes, endospores, storage products, mitochondria and chloroplasts.

Microbial Metabolism: Anabolism and catabolism; Phosphorylation; Glycolysis; TCA cycle; Electron transport chain; Fermentation; Anaerobic respiration; Energy balances; Enzymes and Enzyme kinetics. Growth and Control of Microorganisms: Bacterial nutrition and growth; Specific growth rate and doubling time; Monod's model; Types of culture media; Batch and continuous culture; Effects of environmental factors on growth; Control of microbes using physical and chemical methods.

Microbiology and Health: Pathogens and modes of transmission; Indicator organisms; Quantification of coliforms using MPN and membrane filtration techniques.

Section 3: Water Resources and Environmental Hydraulics

Global Water Resources: Structure, properties and distribution of water; Water quality; Threats to water resources; Water conservation.

Surface Water Resources: Hydrological cycle and water balance - precipitation, infiltration, evapotranspiration, runoff; Flow hydrographs; Unit hydrographs; Stage-discharge relationship; Reservoir capacity; Reservoir and channel routing; Surface run-off models; Surface water management; Rain water harvesting and storage.

Groundwater Resources: Geologic formations as aquifers; Vadose and saturated zones; Confined and unconfined aquifers and their parameters - porosity, permeability, transmissivity and storage coefficient; Darcy's law and applications; Steady state well hydraulics.

Environmental Hydraulics: Concepts of mechanics; Properties of fluids; Pressure measurement; Hydrostatic force on surfaces; Buoyancy and flotation; Laminar and turbulent flow; Flow through pipes; Pipe networks; Boundary layer theory; Forces on immersed bodies; Flow measurement in channels and pipes; Kinematics of flow; Continuity, momentum and energy equations; Channel hydraulics - specific energy, critical flow, hydraulic jump, rapid and gradually varied flow; Design of lined and unlined channels.

Section 4: Water & Wastewater Treatment and Management

Water and wastewater quality parameters; Eutrophication and thermal stratification in lakes; River pollution - Oxygen sag curve.

Water treatment methods - screening, sedimentation with and without coagulation, filtration, desalination, disinfection; Water distribution and storage

Point and non-point sources of wastewater; Population forecasting methods; Design of sewer and storm water sewers; Sewer appurtenances; Preliminary, primary, secondary and tertiary sewage treatment; Sludge generation, processing and disposal methods; Sewage farming.

Sources and characteristics of industrial effluents; Concept of Common Effluent Treatment Plants (CETP); Wastewater recycling and zero liquid discharge.

Kinetics and reactor design: Mass and energy balance, Order and rate of reactions, Batch reactors, Completely mixed flow reactors, Plug flow reactors.

Section 5: Air and Noise Pollution

Structure of the atmosphere; Natural and anthropogenic sources of pollution; Atmospheric sources, sinks, transport; Indoor air pollution; Effects on health and environment; Air pollution: gases and particulate matter; Air quality standards; Primary and secondary pollutants; Criteria pollutants, ambient and source standards, air quality indices, visibility.

MICROELECTRONICS & VLSI

Section 1: Networks, Signals and Systems

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

Linear 2-port network parameters, wye-delta transformation.

Continuous-time Signals: Fourier series and Fourier transform, sampling theorem and applications.

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

Section 2: Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.

Carrier Transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations.

P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

Section 3: Analog Circuits

Diode Circuits: clipping, clamping and rectifiers.

BJT and MOSFET Amplifiers: biasing, ac coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers.

Op-amp Circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

Section 4: Digital Circuits

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

Sequential Circuits: latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay.

Data Converters: sample and hold circuits, ADCs and DACs. Semiconductor Memories: ROM, SRAM, DRAM.

Computer Organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

Section 5: Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

Section 6: Communications

Random Processes: auto correlation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog Communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers.

Information Theory: entropy, mutual information and channel capacity theorem.

Digital Communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER.

Fundamentals of error correction, Hamming codes, CRC.

Section 7: Electromagnetics

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

Plane Waves and Properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission Lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart.

Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

STRUCTURAL ENGINEERING

Section 1: Environmental Chemistry

Fundamentals of Environmental Chemistry: Covalent and ionic bonding; Chemical equations, concentration and activity; Structure and chemistry of organic molecules; Radioactivity of elements; Chemical equilibria; Thermodynamics and kinetics of chemical reactions.

Principles of Water Chemistry: Water quality parameters and their measurement; Acid-base equilibria; Buffer solution; Carbonate system; Solubility of gases in water; Complexation, precipitation, and redox reactions; Inorganic and organic contaminants in water and their speciation.

Soil Chemistry; Organic matter, nitrogen, phosphorous, potassium, cation exchange capacity, base saturation, and sodium absorption ratio.

Atmospheric Chemistry: Composition of the atmosphere; Reactivity of trace substances in the atmosphere; Urban atmosphere—smog and particulate pollution; Chemistry of ozone formation; Chemistry of stratosphere.

Section 2: Environmental Microbiology

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Cell Chemistry and Cell Biology: Structure of proteins, nucleic acid (DNA & RNA), lipids and polysaccharides; Bonds in biomolecules; Stereoisomerism in biomolecules; Structure of cell; Structure and function of cytoplasmic membrane, cell wall, outer membrane, glycocalyx, chromosomes, endospores, storage products, mitochondria and chloroplasts.

Microbial Metabolism: Anabolism and catabolism; Phosphorylation; Glycolysis; TCA cycle; Electron transport chain; Fermentation; Anaerobic respiration; Energy balances; Enzymes and Enzyme kinetics.

Growth and Control of Microorganisms: Bacterial nutrition and growth; Specific growth rate and doubling time; Monod's model; Types of culture media; Batch and continuous culture; Effects of environmental factors on growth; Control of microbes using physical and chemical methods.

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Environmental Hydraulics: Concepts of mechanics; Properties of fluids; Pressure measurement; Hydrostatic force on surfaces; Buoyancy and flotation; Laminar and turbulent flow; Flow through pipes; Pipe networks; Boundary layer theory; Forces on immersed bodies; Flow measurement in channels and pipes; Kinematics of flow; Continuity, momentum and energy equations; Channel hydraulics - specific energy, critical flow, hydraulic jump, rapid and gradually varied flow; Design of lined and unlined channels.

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Water and wastewater quality parameters; Eutrophication and thermal stratification in lakes; River pollution - Oxygen sag curve.

Water treatment methods - screening, sedimentation with and without coagulation, filtration, desalination, disinfection; Water distribution and storage

Point and non-point sources of wastewater; Population forecasting methods; Design of sewer and storm water sewers; Sewer appurtenances; Preliminary, primary, secondary and tertiary sewage treatment; Sludge generation, processing and disposal methods; Sewage farming.

Sources and characteristics of industrial effluents; Concept of Common Effluent Treatment Plants (CETP); Wastewater recycling and zero liquid discharge.

Kinetics and reactor design: Mass and energy balance, Order and rate of reactions, Batch reactors, Completely mixed flow reactors, Plug flow reactors.

Section 5: Air and Noise Pollution

Structure of the atmosphere; Natural and anthropogenic sources of pollution; Atmospheric sources, sinks, transport; Indoor air pollution; Effects on health and environment; Air pollution: gases and particulate matter; Air quality standards; Primary and secondary pollutants; Criteria pollutants, ambient and source standards, air quality indices, visibility.

Particulate Pollutants: measurement and control methods; Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

Gaseous Pollutants: Measurement and control methods; Control of gaseous contaminants: absorption, adsorption, condensation and combustion; Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons; Vapour-liquid and vapour-solid equilibria; Diffusion, Fick's law and interfacial mass transfer.

Automotive emission controls, fuel quality, diesel particulate filters, catalytic convertors.

Air Quality Management: Point, line and area sources; Inventory; Influence of meteorology - wind rose diagrams, stability, mixing height, topography, dispersion modelling, monitoring.

Noise pollution: Sources; Health effects; Standards; Measurement and control methods.

Section 6: Solid and Hazardous Waste Management

Integrated solid waste management; Waste hierarchy; Rules and regulations for solid waste management in India.

Municipal solid waste management: Sources, generation, characteristics, collection and transportation, waste processing and disposal (including reuse options, biological methods, energy recovery processes and landfilling).

Hazardous waste management: Characteristics, generation, fate of materials in the environment, treatment and disposal.

Soil contamination and leaching of contaminants into groundwater.

Management of biomedical waste, plastic waste and E-waste: Sources, generation and characteristics; Waste management practices including storage, collection and transfer.

Section 7: Global and Regional Environmental Issues

Global effects of air pollution – Greenhouse gases, global warming, climate change, urban heat islands, acid rain, ozone hole.

Ecology and various ecosystems; Biodiversity; Factors influencing increase in population, energy consumption, and environmental degradation.

Section 8: Environmental Management and Sustainable Development

Environmental Management Systems; ISO14000 series; Environmental auditing; Environmental Impact Assessment; Life cycle assessment; Human health risk assessment.

Environmental Law and Policy – Objectives; Polluter pays principle, Precautionary principle; The Water and Air Acts with amendments; The Environment (Protection) Act (EPA) 1986; National Green Tribunal Act, 2010; National Environment Policy; Principles of International Law and International treaties.

Energy and Environment: Energy sources – overview of resources and reserves; Renewable and non-renewable energy sources; Energy-Environment nexus.

Sustainable Development: Definition and concepts of sustainable development; Sustainable development goals; Hurdles to sustainability; Environment and economics.

MASTERS OF URBAN PLANNING

Part A: Common

Section 1: Architecture, Planning and Design Architectural Graphics; Visual composition in 2D and 3D; Computer application in Architecture and Planning; Anthropometrics; Organization of space; Circulation-horizontal and vertical; Space Standards; Universal design; Building byelaws; Codes and standards;

Section 2: Construction and Management Project management techniques e.g. PERT, CPM etc.; Estimation and Specification; Professional practice and ethics; Form and Structure; Principles and design of disaster resistant structures; Temporary structures for rehabilitation;

Section 3: Environmental Planning and Design

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

Section 4: Urban Design, Landscape and Conservation

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

Section 5: Planning process

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

Section 6: Housing

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

Section 7: Services and Infrastructure

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

Part B : Planning

Section 1: Regional and Settlement Planning Regional delineation; settlement hierarchy; Types and hierarchy of plans; Various schemes and programs of central government; Transit Oriented Development (TOD), SEZ, SRZ etc.; Public Perception and user behavior; National Housing Policies, Programs and Schemes.; Slums, Squatters and informal housing; Standards for housing and community facilities; Housing for special areas and needs;

Section 2: Planning Techniques and Management

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

Section 3: Infrastructure Planning

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

ENERGY & ENVIRONMENTAL ENGINEERING

SUBJECT:- ELECTRICAL ENGG

Section 1: Electric circuits

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

Section 2: Electromagnetic Fields

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

Section 3: Signals and Systems

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

Section 4: Electrical Machines

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

Section 5: Power Systems Basic concepts of electrical power generation, ac and dc transmission concepts, Models and performance of transmission lines and cables, Economic Load Dispatch (with and without considering transmission losses), Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss-Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor

correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Section 6: Control Systems

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

Section 7: Electrical and Electronic Measurements Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Section 8: Analog and Digital Electronics

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

Section 9: Power Electronics

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

SUBJECT:- MECHANICAL ENGG

Section 1: Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation. Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; 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 SN 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, 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; basics of compressible fluid flow.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped 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, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations. 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; steam and gas 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, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming. Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine

(CMM).

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools; additive manufacturing. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing. Inventory Control: Deterministic models; safety stock inventory control systems. Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

SUBJECT:- ENVIRONMENTAL ENGG

Section 1: Environmental Chemistry

Fundamentals of Environmental Chemistry: Covalent and ionic bonding; Chemical equations, concentration and activity; Structure and chemistry of organic molecules; Radioactivity of elements; Chemical equilibria; Thermodynamics and kinetics of chemical reactions.

Principles of Water Chemistry: Water quality parameters and their measurement; Acid-base equilibria; Buffer solution; Carbonate system; Solubility of gases in water; Complexation, precipitation, and redox reactions; Inorganic and organic contaminants in water and their speciation.

Soil Chemistry; Organic matter, nitrogen, phosphorous, potassium, cation exchange capacity, base saturation, and sodium absorption ratio.

Atmospheric Chemistry: Composition of the atmosphere; Reactivity of trace substances in the atmosphere; Urban atmosphere—smog and particulate pollution; Chemistry of ozone formation; Chemistry of stratosphere.

Section 2: Environmental Microbiology

Prokaryotic and Eukaryotic Microorganisms; Characteristics of diverse groups of microorganisms; Classification of microorganisms; Microbial diversity; Plant-microbe and soil-microbe interactions; Role of microorganisms in wastewater treatment, bioremediation and biogeochemical cycling.

Cell Chemistry and Cell Biology: Structure of proteins, nucleic acid (DNA & RNA), lipids and polysaccharides; Bonds in biomolecules; Stereoisomerism in biomolecules; Structure of cell; Structure and function of cytoplasmic membrane, cell wall, outer membrane, glycocalyx, chromosomes, endospores, storage products, mitochondria and chloroplasts.

Microbial Metabolism: Anabolism and catabolism; Phosphorylation; Glycolysis; TCA cycle; Electron transport chain; Fermentation; Anaerobic respiration; Energy balances; Enzymes and Enzyme kinetics.

Growth and Control of Microorganisms: Bacterial nutrition and growth; Specific growth rate and doubling time; Monod's model; Types of culture media; Batch and continuous culture; Effects of environmental factors on growth; Control of microbes using physical and chemical methods.

Microbiology and Health: Pathogens and modes of transmission; Indicator organisms; Quantification of coliforms using MPN and membrane filtration techniques.
