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## राष्ट्रीय प्रौद्योगिकी संस्थान दुर्गापुर

**NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**

MAHATMA GANDHI AVENUE, DURGAPUR – 713209 (WEST BENGAL), INDIA

*Biomedical Engineering & Assistive Technology (BEAT)*

### Syllabus of the Admission tests for PhD Admission ODD SEM 2021-2022 onwards (BEAT)

#### Part A : Compulsory (by MDC)

##### Module I (Engineering Mathematics):

Matrix algebra, Systems of linear equations, Eigen values and vectors.

Functions of single variable, Limit, continuity and differentiability, Mean value theorems, local maxima and minima, Taylor series, Evaluation of definite and indefinite integrals with applications, Partial and Total derivatives, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals.

First order (linear and non-linear) Ordinary Differential Equation and Fourier series.

Sampling theorems, Conditional probability, Descriptive statistics – Mean, median, mode and standard deviation, Random Variables – Discrete and Continuous, Distribution.

Error analysis, Linear and non-linear algebraic equations, Newton's and Lagrange polynomials, numerical differentiation, Integration by trapezoidal and Simpson's rule.

##### Module II (General Aptitude, Reasoning, English):

English Grammar, Sentence Completion, Verbal Analogies, Word Groups, Instructions, Critical Reasoning, Verbal Deduction

Numerical Computation, Numerical Estimation, Numerical Reasoning, Data Interpretation

#### Part B : Optional, Any one to be attempted

##### 1. Biomaterials & Biofabrication , (by SB, MM)

Natural biological materials, Concept of biocompatibility, Cell-material interactions

Metallic materials in medical application: Stainless steel, Titanium/Zirconium/Magnesium based alloys

Ceramics and glasses-bioceramics, bio-reactive glasses and glass ceramics, porous ceramics; Calciumphosphate ceramics

Processing and properties of different bioceramic materials

Biological Testing of Biomaterials: In Vitro and In Vivo assessment

## **2. Biomedical Devices, Bio-Instrumentation & Bio-sensors , (by SH,CK,MG)**

### **Module I:**

Bio potentials, Resting potential, Action potential, Synaptic Potential-their evolution, transmission and propagation of action potential. Types and nature of bioelectric signals, interaction of signals to perform various functions of our body. Synaptic transmission and transduction in receptors. Electrical circuit model of the membrane The laws of stimulation and conduction in a nerve impulse. Electrophysiological Signals- ECG, EMG, EEG their generation, propagation, recording and diagnostic applications.

### **Module II:**

Basic concept of biomedical instrumentation. Electrodes, transducers, biosensors and their characteristics. Biopotential amplifiers. Biotelemetry. Recording of ECG, EEG, EMG, ERG, evoked potentials etc. Cardiovascular measurements. Measurement of the respiratory system. Analytical instruments in Biomedical Engineering; oximeter, spectrophotometer, colorimeter, blood gas analyzer, blood cell counter.

## **3. Biomechanics & Biomechanical Engineering, (by TKB)**

### **Module I (Mechanics):**

Scalar and vector quantities, different operations on vector, forces and moments, force and pressure, system of forces, system of forces in 3D and 2D, friction, friction and material degradation, stress, strain stress - strain diagram, stress concentration, work, power, energy, velocity, acceleration, materials and its states, structure, strength of material, levers.

### **Module II (Bio-Mechanics):**

Human body structure, biomaterials, introduction to biomedical system, human tissues, soft tissues and hard tissues, human skeletal system, different types of bones, spine, mechanical properties of human bone, viscoelasticity, electric and electromechanical properties of bones, teeth and connective tissues, dental forces, biomedical implants, implant-tissue biomechanics, tissue damage, tissue ageing, bone fracture and crack propagation in bones, introduction to orthopaedic biomechanics, human body dynamics and locomotion analysis, circulatory biomechanics, sports biomechanics, orthopaedic implants and devices, implant materials.

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**4. Assistive Technology & Rehabilitation Engineering (by TKB)**

**Module I :**

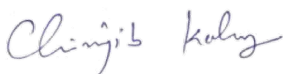
Human Disability, Types of Human Disability, Disability and Social Life, Physical Disability, Disability and Psychological Stresses, Disability and Psychological Stress, Biomedical Instruments, Medical and Biomedical Instruments for Disable Person, Learning Disability, Cognitive Load, Cognitive Load Assessment, Electroencephalography (EEG), EEG based Cognitive Load Assessment, Cognitive Load Analysis for children with learning disabilities.

**Module II :**

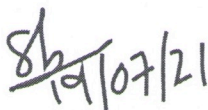
Assistive Technology, Assistive Technology and its Applications, Assistive Technologies for Person with disability, Assistive Technologies for single and multiple disabilities, Cognitive Load Assessment Based Assistive Tool Design. Computers in Medicine and Healthcare, Introduction to Computers, Computation Techniques, Computer Hardware, Computer Software, Computers in Healthcare, Computer Algorithm, Image Computing and Image processing, Medical Softwares, Artificial Intelligence, Machine Learning, Deep Learning, Computer Algorithms, Telemetry, Telemedicine.

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Ph.D Admission Committee@CE



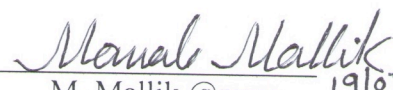
C. Koley @ee

 8/7/21

S. Halder @ee



TK Bera @ee

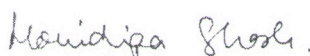


M. Mallik @mme

19/07/2021




S Bera @mme



M Ghosh @bt

M D Chakraborty @cse

Countersigned



Coordinator (BEAT)

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