

SBTA7006	ADVANCED BIOINSTRUMENTATION	L	T	P	C	Total marks
		3	*	0	3	100

COURSE OBJECTIVE:

- The course tends to disseminate the knowledge of various analytical instruments, their usage, interpretation of the results and their application for different macromolecular analysis in Biotechnology.

UNIT 1 BASIC ANALYTICAL TECHNIQUES**9 hours**

Solutions – types of solutions (standard, stock, saturated). Expression of concentrations – molarity, molality, normality, mass fraction, mass percent, ppm, ppb – interconversion. Percentage solutions and ratio solutions – problems.

Microscopy – Bright field, Dark field, Phase contrast, Fluorescence, Scanning and transmission electron microscopy, confocal microscopy- Flow cytometry.

UNIT 2 SEPARATION TECHNIQUES**9 hours**

Cell disruption methods and Cell fractionation – Homogenization media, High pressure homogenization, Ultrasonication – Protein precipitation, ammonium sulphate fractionation of proteins. Centrifugation: Principle, types and applications- Differential, isopycnic density gradient centrifugation, Rate zonal centrifugation. Filtration: Ultrafiltration, reverse osmosis, membrane filtration, Dialysis.

UNIT 3 SPECTROSCOPY AND CHROMATOGRAPHY**9 hours**

Spectroscopy – Principle, block diagram, interpretation of results and applications - UV-Visible spectrophotometer - Infrared, Fluorescence Spectrophotometry, Atomic Absorption Spectrophotometry - Raman Spectroscopy - Mass Spectrometry, NMR and ESR. Chromatography: Principle, methods, interpretation of results and applications- TLC, Column Chromatography - Ion exchange, Gel Filtration and Affinity Chromatography, HPLC and GC

UNIT 4 MOLECULAR TECHNIQUES**9 hours**

Electrophoresis of nucleic acid and proteins: Principles, methods and applications- Agarose gel electrophoresis, Pulse field gel electrophoresis, Capillary Electrophoresis, SDS – PAGE, IEF, 2D PAGE. Blotting techniques - principle, methods and applications - Southern, Northern, Western, Dot, slot and Zoo blot- Immunological techniques: - Ag-Ab reactions- Immuno-electrophoresis- ELISA, RIA.

UNIT 5 TRACER TECHNIQUES AND DIAGNOSTICS**9 hours**

Tracer techniques- autoradiography – radiodosimetry, XRD. Immobilization of cells and enzymes - supercritical fluids methods- Nano biotechnology in molecular diagnosis: current techniques and applications- Biosensors- principle, methods and applications in biotechnology- microfluidics and Biochips technology.

Max. 45 Hrs.**COURSE OUTCOMES:**

- CO1: To define basic nomenclature in analytical biotechnology
- CO2: To possess the ability to demonstrate the different analytical techniques
- CO3: To illustrate the different techniques for better understanding
- CO4: To interpret the results obtained from various methods of analysis
- CO5: To speculate on the analyte based on the different analysis
- CO6: To integrate various techniques for complex problems

RECOMMENDED TEXTBOOKS AND REFERENCES:

1. Thomas G.M. Schalkhammer, Analytical Biotechnology, Springer Basel AG, 2002.
2. Rajan Katoch, Analytical Techniques in Biochemistry and Molecular Biology, Springer, 2011.
3. Keith Wilson and John Walker, Practical Biochemistry - Principles and Techniques, 5th Edition, Cambridge University Press, 2003.
4. Biophysical chemistry : Principles and Techniques – Upadhyay and Nath – Himalaya publishing house, 2nd Review Edition, 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks:100****Exam Duration: 3 hrs.****Part A:** 6 questions of 5 marks each – No choice**30 marks****Part B:** 2 questions from each unit of internal choice, each carrying 14 marks**70 marks**

SCCA9501	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	-	2	2	100

UNIT1 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING**7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. **Bionanotechnology. Intellectual Property rights (IPR):** Case Studies.

UNIT 2 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT**7 Hrs.**

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- **Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming** - Intellectual Property rights: Case studies

UNIT 3 SMART MANUFACTURING**8 Hrs.**

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies- Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 4 SMART WORLD**8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 5 CYBER PHYSICAL SYSTEMS**8 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Willey and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice, Prentice Hall India Pvt Ltd, 2006.
3. FlavioCraveiro, Jose Pinto Duarte, Helena Bartolo and Paulo JorgeBartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, pp. 251-267, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Study lab Publications, 2016
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016
6. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions of 5 marks each-No choice**PART B :** 5 Questions from each unit with internal choice, each carrying 14marks**Exam Duration : 3 Hrs.****30 Marks****70 Marks**