SCHEME and SYLLABUS

for

I Year

BACHELOR OF TECHNOLOGY

in

ROBOTICS AND ARTIFICIAL INTELLIGENCE

(w.e.f. session 2021-2022)

(Choice Based Credit Scheme)

DEPARTMENT OF MECHANICAL ENGINEERING

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

The scheme and Syllabus approved in 20th BOS (UG) held on 30.08.2022; Item No. BOS/20/3

J.C. Bose University of Science & Technology, YMCA, Faridabad
(A Haryana State Government University)
(Established by Haryana State Legislative Act No. 21 of 2009 & Recognized by UGC Act 1956 u/s 22 to Confer Degrees)
Accredited 'A' Grade by NAAC

Ref. No. _____

Dated: 15.12.2022

CERTIFICATE

This is to certify that the scheme & syllabi of B.Tech REAI w.e.f. 2021-22 (course name & scheme) is duly approved by the competent body/authority and to the best of my knowledge the contents of the same, are correct in all respect.

This Scheme & Syllabus has been approved in 20th (UG) (meeting no.) of BOS held on dated 30.08.2022 Item No. - BOS/20/3

R. Kumar 19/12/22

Chairman
Department of Mechanical Engg.
J.C. Bose Univ. of Sc. and Tech.
Sector 9, Faridabad-121006

Date: 15.12.2022

Signature & Stamp of Chairperson

Name: Prof. Raj Kumar

Deptt. Name Mechanical Engg.

15.12.2022

VISION

"J.C. Bose University of Science & Technology, YMCA, Faridabad aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building."

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

SEMESTER WISE SUMMARY OF THE PROGRAMME

S.No.	Semester	Contact Hours	Marks	Credits
1.	I	25 per week	650	19.5
2.	II	26 per week	600	18.5

BASIC SCIENCE COURSES (BSC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	BSC-103RAI	Mathematics-I	4	4	I
2.	BSC-102	Chemistry	4	4	I
3.	BSC-105	Chemistry Lab	3	1.5	I
4.	BSC-101E	Physics (Electromagnetism and Basic Electronics)	4	4	II
5.	BSC-106RAI	Mathematics- II	4	4	II
6.	BSC-104A	Physics Lab	3	1.5	II

ENGINEERING SCIENCE COURSES (ESC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	ESC-101A	Basic Electrical Technology	4	4	I
2.	ESC-107A	Basic Electrical Technology Laboratory	2	1	I
3.	ESC-104A/21	Workshop- I	4	2	I
4.	ESC-103	Programming for Problem Solving	3	3	II
5.	ESC-105	Programming for Problem Solving Lab	4	2	II
6.	ESC-102A/21	Engineering Graphics and Drawing	4	2	II
7.	ESC-106A/21	Workshop- II	4	2	II

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	HSMC-101	English	2	2	I
2.	HSMC-102	English Lab	2	1	I

B.TECH. ROBOTICS AND ARTIFICIAL INTELLIGENCE

(I-II SEMESTER)

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH. 1st YEAR (SEMESTER – I)

ROBOTICS AND ARTIFICIAL INTELLIGENCE (2021-22)

Course Code	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
BSC-103RAI	Mathematics- I	3	1	-	4	25	75	-	100	4	BSC
ESC-101A	Basic Electrical Technology	3	1	-	4	25	75	-	100	4	ESC
BSC-102	Chemistry	3	1	-	4	25	75	-	100	4	BSC
HSMC-101	English	2	-	-	2	25	75	-	100	2	HSMC
ESC-107A	Basic Electrical Technology Laboratory	-	-	2	2	15	-	35	50	1	ESC
BSC-105	Chemistry Laboratory	-	-	3	3	15	-	35	50	1.5	BSC
HSMC-102	English Lab	-	-	2	2	15	-	35	50	1	HSMC
ESC-104A/21	Workshop- I	-	-	4	4	30	-	70	100	2	ESC
	Total	**11**	**3**	**11**	**25**	**175**	**300**	**175**	**650**	**19.5**	

Note: Exams Duration will be as under

(a) Theory exams will be of 03 hours duration.

(b) Practical exams will be of 02 hours duration

(c) Workshop exam will be of 03 hours duration

SVM 2

15.12.2022

Chairman

Department of Mechanical Engineering

J C Bose University of Sc. and Tech., YMCA

Sector-6, Faridabad-121006

(6)

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH. 1st YEAR (SEMESTER – II)

ROBOTICS AND ARTIFICIAL INTELLIGENCE (2021-22)

Course Code	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
BSC-101E	Physics (Electromagnetism and Basic Electronics)	3	1	-	4	25	75	-	100	4	BSC
BSC-106RAI	Mathematics- II	3	1	-	4	25	75	-	100	4	BSC
ESC-103	Programming for Problem solving	3	-	-	3	25	75	-	100	3	ESC
BSC-104A	Physics Electromagnetic Lab	-	-	3	3	15	-	35	50	1.5	BSC
ESC-105	Programming for Problem solving Lab	-	-	4	4	15	-	35	50	2	ESC
ESC-102A/21	Engineering Graphics and Drawing	-	-	4	4	30	-	70	100	2	ESC
ESC-106A/21	Workshop- II	-	-	4	4	30	-	70	100	2	ESC
	Total	**9**	**2**	**15**	**26**	**165**	**225**	**210**	**600**	**18.5**	

Note: Exams Duration will be as under

(a) Theory exams will be of 03 hours duration.

(b) Practical exams will be of 02 hours duration

(c) Workshop exam will be of 03 hours duration

15.12.2022

Chairman
Department of Mechanical Engineering
J.C.Bose University of Sc. and Tech., YMCA
Sector-6, Faridabad-121006

(7)

BSC-103 RAI MATHEMATICS I

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Mathematics II

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

CO2- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3- The tool of power series and Fourier series for learning advanced Engineering Mathematics.

CO4- To deal with functions of several variables that are essential in most branches of engineering.

CO5- The essential tool of matrices and linear algebra in a comprehensive manner.

Course Contents:

Unit 1

Calculus (Integration): Curvature, radius of curvature, evolutes and involutes. Evaluation of definite and Improper integrals. Beta and Gamma functions and their properties. (6)

Unit 2

Calculus (Differentiation): Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima. (6)

Unit 3

Sequence and Series: Convergence of sequences and series, test for convergence; Power series, Taylor series, Fourier series: Half range sine and cosine series. (13)

Unit 4

Multivariable Calculus: Functions of several variables: Limit, continuity and differentiability, partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers. (10)

Unit 5

Matrices: Matrices: Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Properties of Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem. (7)

Recommended/ Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, Brooks/Cole.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 7th Edition, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41 st Edition, 2011.
8. P. Sivaramakrishna Das and C. Vijayakumari, Mathematics-I, Pearson Publisher, 2019.

ESC-101A BASIC ELECTRICAL TECHNOLOGY

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Basic Electronics Engineering

Course Objectives:

The objective of this course is to familiarize the prospective engineers with different electrical concepts of AC and DC and its applications.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Analyze and solve D. C. networks by different analysis methods and theorems.

CO2- Formulate and solve complex AC single phase and three circuits.

CO3- Identify the type of electrical machines and their applications.

CO4- Introduce the components of low voltage electrical installations.

Course Contents:

Unit 1

DC Circuits: Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. **(10)**

Unit 2

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. **(10)**

Unit 3

Poly Phase Systems: Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (star and delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method. **(7)**

(10)

ESC-101A BASIC ELECTRICAL TECHNOLOGY

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Basic Electronics Engineering

Course Objectives:

The objective of this course is to familiarize the prospective engineers with different electrical concepts of AC and DC and its applications.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Analyze and solve D. C. networks by different analysis methods and theorems.

CO2- Formulate and solve complex AC single phase and three circuits.

CO3- Identify the type of electrical machines and their applications.

CO4- Introduce the components of low voltage electrical installations.

Course Contents:

Unit 1

DC Circuits: Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. **(10)**

Unit 2

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. **(10)**

Unit 3

Poly Phase Systems: Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (star and delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method. **(7)**

Unit 4

Transformers: Magnetic Circuits, construction and working of single phase transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto-transformer **(7)**

Unit 5

Electrical Machines: *Induction motor*: Construction, principle and working of a three-phase induction motor, Single-phase induction motor: Construction, principle and working, Applications

DC machine: Construction, principle and working of dc motor and generator. Applications

Synchronous Machine: Construction, principle and working of synchronous motor and generators. Applications. **(9)**

Unit 6

Electrical Installations: Components of LT Switchgear: Fuses, MCB, ELCB, MCCB, Types of Wires, Earthing, Power factor improvement. **(7)**

Recommended/ Reference Books:

1. D. P. Kothari and, I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
4. E. Hughes, "Electrical and Electronics Technology", Pearson.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.

Web Links:

1. **NPTL Web Course, Basic Electrical Technology,** Prof. G. D. Roy, Prof. N. K. De, Prof. T.K. Bhattacharya, IIT Kharagpur (https://nptel.ac.in/courses/108/105/108105053/)
2. **NPTL Web Course, Electrical Machines-I,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras (https://nptel.ac.in/courses/108/106/108106071/)
3. **NPTL Web Course, Electrical Machines-II,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras https://nptel.ac.in/courses/108/106/108106072/

BSC-102 CHEMISTRY
(Concepts in Chemistry for Engineering)
B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Environmental Science

Course Objectives:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2- Rationalise bulk properties and processes using thermodynamic considerations.

CO3- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5- List major chemical reactions that are used in the synthesis of molecules.

Course Contents:

Unit 1

Atomic and molecular structure: Schrodinger equation. Particle in aboxsolutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transitionmetal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. **(12)**

Unit 2

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering. **(9)**

Unit 3

Intermolecular forces and potential energy surfaces: Ionic, dipolar and vanDer Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2 F and HCN and trajectories on these surfaces. **(5)**

Unit 4

Use of free energy in chemical equilibria: Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams. **(8)**

Unit 5

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **(6)**

Unit 6

Stereochemistry: Representations of 3 dimensional structures, structural isomers and stereo isomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism initransitional metal compounds. **(6)**

Unit 7

Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule. **(5)**

Recommended/ Reference Books:

1. University Chemistry, by B. H. Mahan.
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane.
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.

4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
5. Physical Chemistry, by P. W. Atkins.
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E.Schore.

HSMC-101 ENGLISH

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 2
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Contents:

Unit 1

Vocabulary Building: The concept of Word Formation; Root words from foreign languages and their use in English; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms, and standard abbreviations.

Unit 2

Basic Writing Skills: Sentence Structures; Use of phrases and clauses in sentences; Importance of proper punctuation; Creating coherence; Organizing principles of paragraphs in documents; Techniques for writing precisely.

Unit 3

Identifying Common Errors in Writing: Subject-verb agreement; Noun-pronoun agreement; Misplaced modifiers; Articles; Prepositions; Redundancies; Clichés.

Unit 4

Nature and Style of sensible Writing: Describing; Defining; Classifying; Providing examples or evidence.

Unit 5

Writing introduction and conclusion

Unit 6

Writing Practices: Comprehension; Précis Writing; Essay Writing.

ESC-107A BASIC ELECTRICAL TECHNOLOGY LABORATORY

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Pre- Requisite: Basic Electrical Technology

Successive: Nil

Course Objectives:

The objective of this course is to familiarize the prospective engineers with practical aspects of different electrical concepts of AC and DC circuits.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Get an exposure to common electrical components and their ratings.

CO2- Make electrical connections by wires of appropriate ratings.

CO3- Understand the usage of common electrical measuring instruments.

CO4- Understand the basic characteristics of transformers and electrical machines.

CO5- Get an exposure to the working of power electronic converters.

List of Experiments/ Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Verification of network theorem in DC circuits, Thevenin's Theorem, Norton's, Theorem, Superposition Theorem etc.
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Poly phase systems, three phase connections (star and delta), measurement of three phase power.
5. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

HSMC-102 ENGLISH LAB

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

List:

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Communication at Workplace.
5. Interviews.
6. Formal Presentations.

Recommended/ Reference Books:

1. Practical English Usage. Michael Swan.OUP.
2. Remedial English Grammar. F. T. Wood. acmillan.
3. On Writing Well. William Zinsser. Harper Resource Book.
4. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press.
5. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press.
6. Exercises in Spoken English. Parts. I- III CIEFL, Hyderabad. Oxford University Press.

ESC-104A/21 WORKSHOP-I

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 2	Sessional:	30Marks
L T P Total	Practical:	70 Marks
0 0 4 4	Total :	100Marks
	Duration of Exam:	3Hours

Pre- Requisite: Nil

Successive: Workshop- II, Workshop- III, Workshop- IV, Workshop- V, Workshop- VI, Workshop- VII

PART-A

Computer Engineering Workshop

Course Outcomes (COs): After the completion of the course the student will be able to:

CO1- Acquire skills in basic engineering practice.

CO2- Have working knowledge of various equipment's used in workshop.

CO3- Have hands on experience about various machines and their components.

CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

List of Exercises:

1. To study and demonstrate Block diagram of Digital Computer System and explanation of each unit.
2. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
3. To study and demonstrate primary memory and secondary memory.
4. To demonstrate Mother Board/ Main Board and its parts, Chipset, Connectors, Add On Card.
5. To study various processor (Pentium-I, II, III, DUAL Core, i-3, i-5, i-7 etc).
6. To study various types of monitors: LCD /LED/TFT/PLASMA DISPLAY& New Technologies
7. To study different printer types and their working.
8. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application

Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss

9. Introduction to computer networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.
10. Introduction to system security and network security.

PART-B
Electrical Workshop

List of Exercises:

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using

23/0.0076"or 40/0.0076"cable.

PART- C
Electronics Workshop

List of Exercises:

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.
4. To study and demonstrate Vp (peak voltage),Vpp (peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.
6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and wave form observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

BSC-101E PHYSICS
(Electromagnetism and Basic Electronics)
B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Nil

Course Objective:

The objective of studying this course is to understand and apply the concepts of electromagnetism and electronics in the applications of Robotics and Artificial Intelligence.

Course Outcomes (COs): After the completion of this course, the learner will be able to:

CO1- Learn the fundamentals of electrostatics and magnetostatics.

CO2- Understand the basics of analog and digital electronics.

CO3- Verify the energy conservation law for electromagnetic waves using the principles of electromagnetism.

CO4- Differentiate the analog and digital electronics by portraying the basic circuits involved and their applications.

CO5- Apply the basics of digital electronics to simple binary operations like addition and subtraction.

CO6- Identify the current flow mechanisms and gains in semiconductor diodes and transistors.

Course Contents:

Unit 1

Electrostatics and Magnetostatics: Electric field and Electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for Electrostatic potential, Energy of a charge distribution and its expression in terms of electric field. Electrostatic field and potential of a dipole. Bio-Savart law, Differential Equations of Magnetostatics and Ampere's Law; Vector Potential and its solution for given current densities. Self inductance in an inductor and a solenoid. Mutual Inductance. Energy in the Magnetic Field. **(10)**

Unit 2

Faraday's Law and Maxwell's equations: Motional EMF. Eddy currents. Faraday's Law of magnetic induction. Lenz's law. Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; Displacement current. Maxwell's equation in vacuum and non-conducting medium; Electromagnetic fields. Poynting's Theorem and Conservation of Energy for a System of Charged Particles and Electromagnetic Fields. **(10)**

Unit 3

Analog Electronics: P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. Barrier Formation in PN Junction Diode. Current Flow Mechanism in Forward and Reverse Biased Diode. Zener Diode and Voltage Regulation. n-p-n and p-n-p Transistors. I-V characteristics of CB and CE Configurations. Active, Cut off and Saturation Regions. Current gains α and β. Relations between α and β. **(10)**

Unit 4

Digital Electronics: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Binary Addition. Half and Full Adders. Half & Full Subtractors. **(12)**

Text Books:

1. David Griffiths, Introduction to Electrodynamics.
2. Venugopal, Digital Circuits and systems.
3. J.D. Ryder, Electronics: Fundamentals and Applications.

Reference Books:

1. Halliday and Resnick, Physics.
2. W. Saslow, Electricity, magnetism and light.
3. A.P.Malvino, D.P. Leach and Saha, Digital Principles and Applications.
4. S.Salivahanan & N.S.Kumar, Electronic Devices & circuits.
5. S.M. Sze, Semiconductor Devices: Physics and Technology.

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BSC-106A MATHEMATICS II

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Mathematics I

Successive: Nil

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary differential equations. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes (COs): At the end of the course, the student will learn:

CO1- The mathematical tools needed in evaluating multiple integrals and their usage.

CO2- The effective mathematical tools for the solutions of differential equations that model physical processes.

CO3- Basics concepts of Complex Analysis.

CO4- Different tools of differentiation.

CO5-Integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Course Contents:

Unit 1

Multiple integrals and Applications: Multiple Integration, Change of variables in double integrals (Cartesian to polar), Applications: areas and volumes;/; Triple integrals (Cartesian), Scalar line integrals, Gradient, Curl and Divergence, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. (11)

Unit 2

First order ordinary differential equations: Exact equations, Rules for finding the integrating factor for Non-Exact Differential Equation Mdx+Ndy=0, linear and Bernoulli's equations. Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. (5)

Unit 3

Differential equations (Higher order): Linear differential equations of higher order-with constant coefficients. The operator D, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Simultaneous linear differential equations. (9)

Unit 4

Complex Variable (Differentiation): Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic). (10)

Unit 5

Complex Variable (Integration): Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem (without proof), Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine. (8)

Recommended/ Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delh, 8th Edition.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. Sivaramakrishna Das and C. Vijayakumari, Mathematics-I, Pearson Publisher, 2019.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
7. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
8. E. L. Ince, Ordinary Differential Equations, Dover Publications.
9. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-GrawHill.

ESC- 103 PROGRAMMING FOR PROBLEM SOLVING

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 3
L T P Total
3 0 0 0

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Nil

Course Outcomes (COs): At the end of the course, the student will learn:

CO1- To formulate simple algorithms for arithmetic and logical problems.

CO2- To implement conditional branching, iteration and recursion.

CO3- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO4- To use arrays, pointers and structures and apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Course Contents:

Unit 1

Introduction to Programming: (4)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). **(1)**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples. **(1)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. **(2)**

Unit 2

Arithmetic expressions and precedence **(2)**

Conditional Branching and Loops **(6)**

Writing and evaluation of conditionals and consequent branching **(3)**

Iteration and loops **(3)**

Unit 3

Arrays: Arrays (1-D, 2-D), Character arrays and Strings **(6)**

Unit 4

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required). **(6)**

Unit 5

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference **(5)**

Unit 6

Recursion: Recursion, as a different way of solving problems. Example Programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort. **(4-5)**

Unit 7

Structure: Structures, Defining structures and Array of Structures. **(4)**

Unit 8

Pointers

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation). **(2)**

Unit 9

File handling (only if time is available, otherwise should be done as part of the lab)

Recommended/ Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. E. Balaguruswamy, Programming in ANSIC, Tata Mc Graw-Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall.

BSC-104A PHYSICS ELECTROMAGNETIC LAB

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 1.5
L T P Total
0 0 3 0

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

List of Experiments:

At least 06 experiments from the following

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan's law of radiation and to determine Stefan's constant.
12. To determine Boltzmann constant using V-I characteristics of PN junction diode.

Note: Experiments may be added or deleted as per the availability of equipments.

Recommended/ Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.
3. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, Springer.

ESC- 105 PROGRAMMING FOR PROBLEM SOLVING LAB

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Course Outcomes (COs): At the end of the course, the student will learn:

CO-1 To formulate the algorithms for simple problems.

CO2- To translate given algorithms to a working and correct program.

CO3- To be able to correct syntax errors as reported by the compilers.

CO4-To be able to identify and correct logical errors encountered at run time.

CO5- To be able to write iterative as well as recursive programs.

CO6- To be able to represent data in arrays, strings and structures and manipulate them through a program.

CO7- To be able to declare pointers of different types and use them in defining self-referential structures.

CO8- To be able to create, read and write to and from simple text files.

Tutorial 1: Problem solving using computers:

Lab 1: Familiarization with programming environment.

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions.

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1 D Arrays: searching, sorting:

Lab 5: 1 D Array manipulation

Tutorial 6: 2 D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: *Numerical methods (Root finding, numerical differentiation, numerical integration)*:

Lab 8 and 9: *Programming for solving Numerical methods problems*

Tutorial 10: Recursion, *structure of recursive calls*

Lab 10: Recursive functions

Tutorial 11: Pointers, *structures and dynamic memory allocation*

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

ESC- 102A/21 ENGINEERING GRAPHICS AND DRAWING

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 30 Marks
Practical: 70 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: CAD/CAM

Course Objectives:

The objective of studying this course is to understand the basic principles of engineering drawing and graphics and to apply the same to daw different types of projections.

Course Outcomes: At the end of the course, the student shall be able to:

CO 1- Understand the basic principles of projections of points and lines.

CO 2- Know the different orientations and projections of planes and solids.

CO 3- Learn about the projections of sectioning of solids in different orientations and development of surfaces.

CO 4- Draw orthographic and isometric view of an object.

CO 5- Learn about the basics of AUTOCAD

Course Contents:

Unit 1

Introduction: Importance, Significance and scope of Engineering Drawing, Usage of drawing Instruments, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic projections of simple engineering objects, B.I.S Specifications. **(12)**

Unit 2

Projection of Points & Lines: Introduction of plane of projection, reference & auxiliary planes, projection of points and line in different quadrants, traces, inclinations & true lengths of the lines, projections on auxiliary plane, shortest distance intersecting and non intersecting lines. **(8)**

Unit 3

Projection of Planes and Solids: Parallel to one reference plane, inclined to one plane but perpendicular to the other, inclined to both reference planes. Projection of Polyhedra, solids

of revolution-in simple positions with axis perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other. **(8)**

Unit 4

Sectioning of Solids and Development of Surfaces: Projections of sections of prisms, pyramids, cylinders and cones. Development of simple object with and without sectioning. **(4)**

Unit 5

Isometric Projections: Introduction, isometric scale, Isometric view of plane figures, prisms, pyramids and cylinders. **(4)**

Unit 6

Overview of Computer Graphics: Introduction to AUTOCAD and practice of simple exercises related to the above units on CAD Software. **(8)**

Recommended/ Reference Books:

1. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.
2. A Text Book of Machine Drawing - P S Gill Pub.: S K Kataria & Sons.
3. A Text Book of Engineering Drawing and Machine Drawing by M. L. Aggarwal and Sandhya Dixit: Dhanpat Rai & Co.
4. Textbook on Engineering Drawing, K. L. Narayana and P. Kannaiah, Scitech Publishers

Web Links:

S.N	Address of web source	Content
1.	https://youtu.be/2C8H2rIwhrA	Engineering Drawing
2.	https://youtu.be/xzi_R8lims0	Drawing Layouts

ESC-106A/21 WORK SHOP-III

B. Tech (Robotics and Artificial Intelligence) III Semester

MECHANICAL ENGINEERING WORKSHOP

	Sessional:	30Marks
	Practical:	70 Marks
No. of Credits: 2	Total :	100Marks
L T P Total	Duration of Exam:	3 Hours
0 0 4 4		

Pre- Requisite: Workshop -I

Successive: Workshop- III, Workshop- IV, Workshop- V, Workshop- VI, Workshop- VII

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Acquire skills on basic engineering materials and safety aspects.

CO 2- Understand the fundamental concept of various basic engineering practices namely fitting, sheet metal, carpentry, pattern making and welding etc.

CO 3- Learn and use different marking & measuring instruments used in machine shop, fitting shop, sheet metal shop, carpentry & pattern making shop etc.

CO 4- Practice real time job preparation using various operations related to fitting, sheet metal, carpentry, welding & foundry etc.

List of Exercises:

Machine shop, fitting shop, sheet metal shop, carpentry & pattern making shop, welding shop, foundry shop, forging (smith) shop and injection moulding shop.

Section (A): Machine Shop

1. To understand the layout, safety measures and fundamental concept of different engineering materials used in the workshop.
2. To study and demonstrate the various parts, specifications & operations on lathe, milling and shaping machine.
3. To study different types of measuring tools used in metrology and determine the least count of vernier calipers, vernier height gauges and micrometers.

Section (B): Fitting & Sheet Metal Shop

4. To study different types of tools, equipments, devices and machines used in fitting shop.
5. To prepare a job involving filing, drilling, tapping and hacksaw cutting operations on mild steel plate.
6. To study various types of sheet metal tools and prepare a simple sheet metal joint.

Section (C): Carpentry and Pattern Making Shop

7. To study various types of carpentry and pattern making tools and equipments.
8. To prepare a simple wooden joint (cross lap / Tee-lap/dovetail joint) using kail wood in carpentry shop.
9. To prepare single piece pattern / split pattern using kail wood in pattern making shop.

Section (D): Welding Shop

10. To practice striking an arc and prepare straight short bead on given M.S. plate in flat position by arc welding.
11. To prepare straight continuous bead and re start of electrode in flat position by arc welding on given M.S. plate as per size.
12. To practice tack weld &close butt joint in flat position by arc welding on given M.S. plate as per size.

Section (E): Foundry, Forging (Smithy) & Injection Moulding shop

13. To study various types of foundry tools and prepare a mould cavity using single/split pattern in moulding sand.
14. To study various types of forging / black smithy tools and prepare a ring or hook by hand forging operation.
15. To study the working of injection molding machine and prepare a simple component by injection moulding.

NOTE: - Total twelve exercises should be performed from the above list. At least two from each section and remaining two may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.