Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Civil Engg.)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	BT521	HSMC	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3
2	CE502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	CE503	PCC	Structural Analysis-I	70	20	10	30	20	150	3	-	2	4
4	CE504	PCC	Geotechnical Engineering-II	70	20	10	30	20	150	3	-	2	4
5	CE505	PCC	Structural Design-I (RCC)	70	20	10	30	20	150	3	-	2	4
6	CE407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	CE508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code CE508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	CE502A	Elements of Environmental Engineering
2	CE502B	Water Resource Conservation
3	CE502C	Water Resource Engineering

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

DEAN Academic
JEC, Jabalpur (M.P.)

Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. [AICTE] CE/EE/IT/IP) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT521	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3

Module - 1

Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Module - 2

Market Structure Perfect Competitions Imperfect - Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break - Even Analysis.

Module - 3

Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Module - 4

Management Aspects, Functions of Management, Project Management, Value Engineering, Project Evaluation, Work simplification – process charts and flow diagrams, Production Planning, Decision Making.

Module - 5

Inventory Control: Inventory, Cost, Deterministic Models

Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson

Course Code : BT521
Course Category : HSMC
Course Name : **Engineering Economics and Management**

After completion of this course students will be able to-

CO1: Understand the key management concepts, principles and contribution by different Management thinkers.
CO2: Analyze and design organization for effective management.
CO3: Application of modern management techniques.

B.Tech (AICTE), V Semester

ELEMENTS OF ENVIRONMENTAL ENGINEERING

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Elements of Environmental Engineering	CE502A	3	1	-	4

Module-I

Water sources- origin of waste water – types of water pollutants and their effects, sources of water pollution and their effects

Module-II

Air pollution - causes of air pollution – types & sources of air pollutants- climatic & meteorological effect on air pollution concentration- formation of smog and fumigation, different air pollution episodes in India and abroad.

Module-III

Sources and types of municipal solid wastes - sources and types of solid wastes – factors affecting generation of solid wastes; characteristics - effects of improper disposal of solid wastes – public health effects- principle of solid waste management – social & economic aspects- public awareness- role of NGOs- legislation

Module-IV

Noise pollution & control - noise pollution: intensity, duration – types of industrial noise – ill effects of noise – noise measuring & control – permissible noise limits

Module-V

Environmental Impact Assessment- assessment of impact on land, water and air, noise, social, cultural flora and fauna - Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS) – EIA capability and limitations – legal provisions on EIA.

References

1. Garg, S.K, (2015) "Environmental Engineering (Vol.II): Sewage disposal and Air Pollution Engineering" Khanna Publishers (33th Edition, 2008).
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G, (1985), "Environmental Engineering" McGraw-Hill international edition (7th Edition).
3. Dr. B.S.N. Raju, (1995), "Water supply and Waste Water Engineering" McGraw-Hill Education
4. Dr. P.N. Modi,(2010), "Sewage treatment disposal and waste water engineering" Standard Book House-Delhi (4th Edition)
5. Urban and Jain (1993) "Environmental Impact Assessment", McGraw-Hill Education 6. Relevant I.S. Codes.

B.Tech (AICTE), V Semester

WATER RESOURCES ENGINEERING

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Water Resources Engineering	CE502C	3	1	-	4

Module-I

Hydrology: Hydrological cycle, precipitation and its measurement, recording and non recording rain gauges, estimating missing rainfall data, rain gauge net works, mean depth of precipitation over a drainage area, mass rainfall curves, intensity-duration curves, depth-area duration curves, infiltration and infiltration indices, evaporation stream gauging, run off and its estimation.

Module-II

Hydrographs and Floods: Hydrograph analysis, unit hydrograph and its derivation from isolated and complex storms, S-curve hydrograph, synthetic unit hydrograph, types of floods and their estimation by different methods, probability and frequency analysis, flood routing through reservoirs and channels, flood control measures, economics of flood control.

Module-III

Water Resources Planning & Irrigation: Irrigation water requirement and soil-water-crop relationship, irrigation, definition, necessity, advantages and disadvantages, types and methods, irrigation development, soil types and their occurrence, suitability for irrigation purposes, wilting coefficient and field capacity, optimum water supply, consumptive use and its determination, irrigation method, surface and subsurface, sprinkler and drip irrigation, duty of water, factors affecting duty and methods to improve duty, suitability of water for irrigation, crops and crop seasons, principal crops and their water requirement, crop ratio and crop rotation, intensity of irrigation, water logging-causes, effects and its prevention, salt efflorescence-causes and effects, reclamation of water logged and salt affected lands.

Module-IV

Canal Irrigation: Types of canals, alignment, design of unlined and lined canals, Kennedy's and Lacey's silt theories, typical canal sections, canal losses, linings-objectives, materials used, economics, canal falls & cross drainage works, - description and design, head and cross regulators, escapes and outlets, canal transitions.

Module-V

Ground Water & Well Irrigation : Confined and unconfined aquifers, aquifer properties, hydraulics of wells under steady flow conditions, infiltration galleries, ground water recharge necessity and methods of improving ground water storage, rain water harvesting, types of wells, well construction, yield tests, specific capacity level and specific yield, hydraulic design of open wells and tube wells, methods of raising well water, characteristics of pumps and their selection, interference of wells, well losses, advantages and disadvantages of well irrigation.

Suggested books :-

1. Engineering Hydrology - J.NEMEC - Prentice Hall
2. Engineering Hydrology by K. Subhramanya - Tata Mc Graw Hills Publ. Co.
3. Hydrology and Water Resources Engineering by S.K.Garg - Khanna Publishers
4. Hydrology: Principles, Analysis, Design by H.M. Raghunath – New Age International Pvt. Ltd.
5. Irrigation Irrigation &Water Power Engineering by B.C.Punmia- Laxmi Publications Pvt. Ltd.
6. Irrigation Engineering and Hydraulic Structures by S.K.Garg- Khanna Publishers

B. Tech V Sem

Civil Engineering

Course Articulation Matrix (5th Sem AICTE)														
SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
CE502C Water Resources Engineering	CO1	Illustrate Hydrologic Cycle and its Hydrological Background													
	CO2	Apply different water harvesting techniques and ground water recharge													
	CO3	Analyze different water mangement techniques													

B.Tech (AICTE), V Semester

STRUCTURAL ANALYSIS – I

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Structural Analysis –I	CE503	3	–	2	4

Module-I: **Static and Kinematics Indeterminacy, Virtual Work and Energy Principles:**

Principles of virtual work applied to deformable bodies, strain energy and complementary energy, energy theorems, Maxwell's Reciprocal theorem, Analysis of pin-jointed frames for static loads.

Module-II : **Indeterminate Structures -I:**

Analysis of fixed and continuous beams by theorem of three moments, effect of sinking and rotation of supports, moment distribution method (without sway)

Module-III : **Indeterminate Structures -II:**

Analysis of beams and frames by slope deflection method, column analogy method.

Module-IV : **Arches and Suspension Cables:**

Three hinged arches of different shapes, Eddy's Theorem, suspension cable, stiffening girders, two hinged and fixed arches - rib shortening and temperature effects.

Module-V : **Rolling loads and Influence Lines:**

Maximum SF and BM curves for various types of rolling loads, focal length EUDL, influence lines for determinate structures - beams, three hinged arches.

Books for reference:

1. Wang C.K. Intermediate Structural Analysis, Mc Graw Hill New York.
2. Kinney, Sterling J: indeterminate Structural Analysis Addison wasley
3. Reddy C S Basic Structural Analysis Tata Mc Graw Hill Pub. Co. New Delhi.

STRUCTURAL ANALYSIS LAB – I

List of Experiments:

1. To verify "theorem of reciprocal deflections" or "Maxwell's Reciprocal Theorem" using SSB.
2. To verify "theorem of reciprocal deflections" or "Maxwell's Reciprocal Theorem" using cantilever beam.
3. To verify "Principle of superposition for deflection" using SSB beam made with linearly elastic material.
4. To verify "Principle of superposition for deflection" using Cantilever beam made with linearly elastic material.
5. To draw "influence line diagram for bending moment" at a section of SSB using bending moment apparatus.
6. To obtain horizontal thrust at support of a "Circular three hinged arch" and to draw ILD for this horizontal thrust, also to compare experimental results with analytical solutions;
7. To obtain horizontal thrust at support of a "semicircular two hinged arch" and to draw ILD for this horizontal thrust, also to compare experimental results with analytical solutions.

B.Tech (AICTE), V Semester

GEOTECHNICAL ENGG – II

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Geotechnical Engg-II	CE504	3	–	2	4

Module-I: **Shallow foundations :**

Type of foundations shallow and deep bearing capacity of foundation on cohesion less and cohesive soils, general and local shear failures, factors effecting B.C., theories of bearing capacity, Prandtl. Tezaghi Balla, Skempton Meyerhof and Hansan, I.S. code on B.C. determination of bearing capacity limits of total and differential settlements. plate load test.

Module-II: **Deep foundation :**

Pile foundation, types of piles, estimation of individual and group capacity of piles in cohesion less and cohesive soils. static and dynamic formulae. pile load test. settlement of pile group negative skin friction, under-reamed piles and their design piles under tension, inclined and lateral load caissons, well foundation equilibrium of wells, analysis for stability, remedial measures.

Module-III: **Soil improvement techniques:**

Compaction field and laboratory methods. Proctor compaction tests, factors affecting compaction. properties of soil affected by compaction. various equipment for field compaction and their suitability. field compaction control. lift thickness. soil stabilization : mechanical, lime, cement, bitumen, chemical, thermal, electrical-stabilization and stabilization by grouting. geo-synthetics, types, functions, materials and uses.

Module-IV: **Soil exploration and foundations on expansive and collapsible soils :**

Methods of soil exploration. planning of exploration program me for buildings, highways and earth dams. disturbed and undisturbed samples and samplers for collecting them, characteristics of expansive and collapsible soils, their treatment, construction techniques on expansive and collapsible soils. CNS layer.

Module-V: **Sheet piles/bulkheads and machine foundation:**

Classification of sheet piles/bulkheads. cantilever and anchored sheet piles, cofferdams, materials, types and applications. modes of vibration. mass-spring analogy, natural frequency. effect of vibration on soils. vibration isolation. criteria for design design of block foundation for impact type of machine.

Books for reference :

1. Soil Mechanics & Foundation Engg. By Dr. K.R. Arora - Std Pub. Delhi
2. Soil Mechanics & Foundation Engg. By B.C. Punmia - Laxmi Pub. Delhi
3. Modern Geotechnical Engg. By Dr. Alam Singh-lBT Publishers Delhi
4. Geotechnical Engg. By C. Venkatramaiah- New Age Intemational Pub Delhi
5. Foundation Engg.By GAleonards Mc Graw Hill Book Co. Inc.DT.

GEOTECHNICAL ENGINEERING – II LAB

List of Experiments:

1. The unconfined compression test
2. Tri-axial compression test.
3. Vane shear test.
4. CBR test.
5. Plate load test.
6. Standard penetration test.
7. Dynamic cone penetration test
8. Free swelling index and differential free swell test
9. Swelling pressure test.
10. Consolidation test.

B. Tech V Sem — Civil Engineering

Course Articulation Matrix (5th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
CE504 Geotechnical Eng - II	CO1	Determine allowable bearing pressure of soil for shallow foundations.			2										
	CO2	Evaluate Individual and group capacity of piles.			2										
	CO3	Apply techniques for soil improvement and soil stabilization.	3												
	CO4	Explain behavior and construction techniques for expansive and collapsible soil.	2												
	CO5	Design sheet pile and machine foundation.			3										
CE504 Geotechnical Eng - II LAB	CO1	Evaluate strength of soil through different methods.				1					1	1		1	
	CO2	Determine settelment of different types of soil.		1							1			2	

B.Tech (AICTE), V Semester

STRUCTURAL DESIGN – I (RCC)

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Structural Design–I (RCC)	CE505	3	–	2	4

Module-I

Basic principles of structural design : assumptions, mechanism of load transfer, various properties of concrete and reinforcing steel, introduction to working stress method ; limit state methods of design, partial safety factors for load and material. calculation of various loads for structural design. calculation of moment of resistance of rectangular and flanged sections by WSM and LSM.

Module-II

Design of beams: singly & doubly reinforced rectangular & flanged beams, lintel, cantilever, simply supported and continuous beams, beams with compression reinforcement: redistribution of moments in continuous beams, design of beam for shear, bond and torsion.

Module-III

Design of slabs: slabs spanning in one direction. cantilever, simply supported and continuous slabs, slabs spanning in two directions, circular slabs.

Module-IV

Columns & footings: effective length of columns, short and long columns- square, rectangular and circular columns, isolated footings. columns subjected to axial loads and bending moments (sections with no tension).

Module -V

Staircases: staircases with waist slab having equal and unequal flights with different support conditions, slab less tread-riser staircase. design of flat slabs and waffle slabs.

NOTE :

All the designs for strength and serviceability should strictly be as per the latest version of IS:456. Use of SP-16 Design aids)

Books for Reference :

1. Reinforced Concrete; Pillai & Menon, TMC New Delhi.
2. Plain & Reinforced Concrete Vol. I & II - O.P. Jain & Jay Krishna
3. Limit State Design by P.C.Varghese ; Prentice Hall of India, New Delhi.
4. Design of Reinforced Concrete Elements by Purushothman; Tata McGraw Hill, New Delhi
5. Reinforced Cement Concrete by Gupta & Mallick, Oxford and IBH
6. Reinforced Cement Concrete by P. Dayaratnam, Oxford and IBH
7. Plain & reinforced concrete - Rammuttham
8. Plain & reinforced concrete - B.C. Punnia
9. Structural Design & Drawing by N.K.Raju.

STRUCTURAL DESIGN - I (RCC) LAB

List of Experiments:

1. Detailed of drawing of beams.
2. Detailed of drawing of slabs.
3. Detailed of drawing of colums.
4. Detailed of drawing of footings.
5. Detailed of drawing of stairs.

B. Tech V Sem

Civil Engineering

Course Articulation Matrix (5th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
CE505 Structural Design I (RCC)	CO1	Classify different design philosophies used in RCC construction and assess various loads for the buildings.		2											
	CO2	Design different types of beams for flexure, shear and torsion.			3									2	
	CO3	Design different types of slabs.			3									2	
	CO4	Identify the effective length of column and design of long and short column and isolated footing.		2										2	
	CO5	Design staircases with different support conditions, design of flat slabs and waffle slabs.			3									2	
CE505 Structural Design I Lab (RCC)	CO1	Identify the major steps and symbol used in civil engineering drawings	2								1			2	
	CO2	Draw civil engineering drawings for different structural elements like beam , column, slab etc	2				1				1				

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Bachelor of Technology (B.Tech.) V Semester (Computer Science & Engg.)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	BT511	HSMC	Professional Ethics	70	20	10	-	-	100	3	-	-	3
2	CS502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	CS503	PCC	Database Management Systems	70	20	10	30	20	150	3	-	2	4
4	CS504	PCC	Computer Graphics & Multimedia	70	20	10	30	20	150	3	-	2	4
5	CS505	PCC	Artificial Intelligence	70	20	10	30	20	150	3	-	2	4
6	CS407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	CS508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code CS508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	CS502A	Virtual Reality
2	CS502B	Theory of Computation
3	CS502C	Advance Computer Architecture

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

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B. Tech. (AICTE) V Sem. (EC/CSE)

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT511	Professional Ethics	70	20	10	-	-	100	3	-	-	3

Module – I HUMAN VALUES
Morals, values and Ethics – Integrity – Work ethics – Service learning – Civics virtue – respect for others – Living peacefully – Caring – Sharing – Honestly – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

Module – II ENGINEERING ETHICS
Sensors of 'Engineering Ethics' – Variety of moral issues – Types of inquiry - Moral dilemmas – Moral Autonomy – Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Module – III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation - Engineering as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

Module- IV SAFETY, RESPONSIBILITIES AND RIGHT
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – collective Bargaining – Confidentially – Conflicts of interest – Occupational Crime – Professional Rights - Employee Rights – intellectual Property Rights (IPR) – Discrimination

Module- V GLOBLE ISSUES
Multinational Corporations – Environment Ethics – Computer Ethics – Weapons Development – Engineering as Managers – Consulting Engineers - Engineering as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

Outeomes:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS :

1. Mike W.Martin and Roland Schinzinger, " Ethics in Engineering" Tata Mc-Graw Hill New Delhi, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004

References:

1. Charles B. Feddemann, "Engineering Ethics" Pearson Prentics Hall, New Jersey, 2004
2. Charles E. Herris, Michael S. Pritchard and Michael J. Rabins "Engineering Ethics – Concepts and Cases", Learing, 2009
3. John R Boatright, " Ethics and the Conduct of Business" , Pearson Education, New Delhi, 2003
4. Edumund G Seebauer and Robert L Barry, " Fundamental of Ethics for Scientists and Engineers", Oxfoed University Press , Oxford, 2001
5. Laura P. Hartman and joe Desjardins, " Business Ethics: Decision Making for Personal Integrity and Social Responsibility " Mc Graw Hill education India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, " Value Education ", Vethathiri publication , Erode, 2011

16/7/19

PROFESSIONAL ETHICS (BT511)

Course outcome students will be able to:

CO1 : Understand Human values

CO2 : Apply Engineering Ethics

CO3 : Apply Engineering As social expectation

CO4 : Assess Safety and risks

CO5 : Deep Perception of Global Issues

Jabalpur Engineering College, Jabalpur
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B. Tech. (AICTE) V Sem. (Computer Science & Engineering)

CS 502 (OPEN ELECTIVE-I)

Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assign ment	End Sem	Lab Work	Total Marks				
CS 502A	Virtual Reality	70	20	10	-	-	100	3	1	-	4

Module I: Introduction to Virtual Reality:
Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Simple 3D modelling, Illumination models, Reflection models.

Module II: Geometric Modelling:
Introduction, From 2D to 3D, 3D space curves, 3D boundary representation. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.

Module III: Virtual Environment
Virtual Environment: Introduction, Model of interaction, VR Systems, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Module IV: VR Hardware and Software
Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

Module V: VR Applications
Introduction, Engineering, Entertainment, Science, Training. The Future: Virtual environment, modes of interaction.

Suggested Books:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
3. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill
4. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science.
5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann.

VIRTUAL READING (CS502A)

CO1 : Understand basic concepts of computer graphics, geometric modelling and VR system.

CO2 : Identify problem statements and function as a member of an engineering design team, virtual environment and utilization of technical resources.

CO3 : Analyze 3D computer graphics, geometric transforms, VR hardware and software methods.

CO4 : Design VR systems and perform simulations using VR software and toolkits.

Jabalpur Engineering College, Jabalpur
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B. Tech. (AICTE) V Sem. (Computer Science & Engineering)

CS 502 (Open Elective -I)

Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS 502B	Theory of Computation	70	20	10	-	-	100	3	1	-	4

Module-I : Introduction of Automata Theory:
Examples of automata machines, Finite Automata as a language acceptor and translator, Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, Equivalence of NDFA and DFA, minimization of automata machines, 2 way DFA. Moore mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.

Module-II: Regular Expressions and Languages:
Arden's theorem. Finite Automata and Regular Expressions, From DFA's to Regular Expressions, Converting DFA's to Regular Expressions. Properties of Regular Languages, The Pumping Lemma for Regular Languages, Applications of the Pumping Lemma Closure Properties of Regular Languages, Decision Properties of Regular Languages.

Module –III: Grammars:
Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, Eliminating null and unit productions. Chomsky normal form and Greibach normal form.

Module-IV: Push down Automata:
example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petrinet model.

Module-V: Turing Machine:
Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable & undecidable languages, Halting problem of Turing machine & the post correspondence problem.

Suggested Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Pearson Education, India.
2. K. L. P Mishra, N. Chandrashekaran "Theory of Computer Science-Automata Languages and Computation", Prentice Hall of India.
3. Harry R. Lewis & Christos H. Papadimitriou, , "Element of the Theory computation ", Pearson.
4. Cohen, D.I. and Cohen, D.I., "Introduction to computer theory" , Wiley.

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Suject: Theory of Computation (CS502B)

Course Outcomes: after completion of course student will be able to:

CO1. Illustrate conceptual knowledge of switching and finite automata theory & languages.

CO2. Develop concept of abstract models of computing such as NFA, DFA, PDA, Turing machine and to check their power to recognize the languages.

CO3. Interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.

CO4. Classify types of grammars, simplification and normal form and P, NP problems.

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CS502 (Open Elective-I)

Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS 502C	Advance Computer Architechture	70	20	10	-	-	100	3	1	-	4

Module I: Fundamentals:
Flynn's Classification, System Attributes to Performance, Parallel computer models - Multiprocessors and multicomputers, Multivector and SIMD Computers. Data and resource dependences,Hardware and software parallelism,Program partitioning and scheduling, Grain size and latency, Control flow, data flow and Demand driven mechanisms. Static interconnection networks,Dynamic interconnection Networks: Bus Systems, Crossbar Switch, Multiport Memory, Multistage and Combining Networks

Module II: Memory Organization:
Instruction set architecture, CISC Scalar Processors , RISC Scalar Processors, VLIW architecture, Memory Hierarchy, Inclusion, Coherence and Locality, Memory capacity planning. Interleaved memory organization- memory interleaving, pipelined memory access, Bandwidth and Fault Tolerance. Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt.

Module III: Pipelining:
Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling - score boarding and Tomosulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscaler pipeline design, Super pipeline processor design.

Module IV: Vector Processing & Memory models:
Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer network, deadlock and virtual channel. Vector Processing Principles, Vector instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD organization: distributed memory model and shared memory model. Principles of Multithreading: Multithreading Issues and Solutions, Multiple-Context Processors

Module V: Programming models:
Parallel Programming Models, Shared-Variable Model, Message-Passing Model, Data-Parallel Model, Object-Oriented Model, Functional and Logic Models, Parallel Languages and Compilers, Language Features for Parallelism, Parallel Programming Environment, Software Tools and Environments.

Suggested Books:

1. John L Hennessey, David A Patterson, "Computer Architecture A Quantitative Approach", Elsevier.
2. Kai Hwang and Faye Briggs, "Computer Architecture and Parallel Processing", McGraw-Hill.
3. Sima D, Fountain T and Kacsuk P, "Advanced Computer Architectures: A Design Space" Addison Wesley

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ADVANCE COMPUTER ARCHITECTURE (CS502C)

Course outcome a student should be able to:

CO1 : Understand the organisation and operation of current generation parallel computer systems, multiprocessor, multicore systems and vector processing.

CO2 : Apply the pipelining concept for a given set of instruction.

CO3 : Analyse the components and operation of a memory hierarchy and the range of performance issues influencing its design.

CO4 : Evaluate different processor architectures and system-level design processes.

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Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS 503	Database Management Systems	70	20	10	30	20	150	3	0	2	4

Module I: Introduction:
General introduction to database systems, DBMS Concepts and architecture, Data models-Hierarchical, Network and Relational, Three-schema architecture of a database, Data independence- Physical and Logical data independence. Challenges in building a DBMS, Various components of a DBMS

Module II: Entity Relationship Model:
Conceptual data modeling - motivation, Entities, Entity types, Various types of attributes, Relationships, Relationship types, E/R diagram notations, Keys: Super key, Candidate key, Primary Key, Alternate key and Foreign key. Extended ER features: Specialization, Generalization, Aggregation, Examples.

Module III: Relational Data Model:
Relational Data Model: Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys; Relational Algebra: Selection, Projection, Cross product, Various types of joins, Division, Example queries; Converting the database specification in E/R notation to the relational schema; SQL: Introduction, Data definition in SQL, Table, key and foreign key definitions, Update behaviors, Querying in SQL, Basic select-from- where block and its semantics, Nested queries, Aggregation functions group by and having clauses.

Module IV: Functional Dependencies and Normal forms:
Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, Minimal covers; Definitions of 1NF, 2NF, 3NF and BCNF, Decompositions and desirable properties of them; Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.

Module V: Transaction Processing and Recovery Concepts:
Concepts of transaction processing, ACID properties, Testing for Serializability of schedules, conflict & view serializable schedule, recoverability; Concurrency Control: Locking based protocols for CC; Deadlock handling; Recovery from transaction failures: Log based recovery, Checkpoints.

Suggested Books:

1. Avi Silberschatz, Henry F. Korth, S. Sudarsan, Database System Concepts.
2. Elmasi, R. and Navathe, S.B., "Fundamentals of Database Systems", Pearson Education.
3. Date, C. J., "Introduction to Database Systems", Pearson Education.
4. Ramakrishnan, R. and Gekhre, J., "Database Management Systems", McGraw-Hill.
5. Vipin C Desai, "An Introduction to database systems", Galgotia.

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Suject: Database Management System (CS503)

Course Outcomes: after completion of course student will be able to:

CO1. Explain the fundamental concepts of Database Management Systems, Data models, Normalization, Transaction management & Recovery.

CO2. Apply normalization concepts for designing database.

CO3. Design ER Model and Relational Model of the database for the given problem.

CO4. Formulate SQL commands (DDL, DML, DQL) for the given problem statement.

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Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assign ment	End Sem	Lab Work	Total Marks				
CS 504	Computer Graphics and Multimedia	70	20	10	30	20	150	3	-	2	4

Module-I : Fundamentals:
Introduction to Raster Scan displays, Pixels, Frame buffer, Vector & Character generation, Random Scan systems, Display devices, Scan Conversion techniques, Line Drawing: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms: Midpoint Circle drawing and Bresenham's Algorithm, Polygon fill algorithm: Boundary-fill and Flood-fill algorithms

Module-II : 2-D Transformation:
Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogenous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping & Polygon Clipping Algorithms.

Module-III : 3-D Transformations:
Translation, Rotation and Scaling. Parallel & Perspective Projection: Types of Parallel & Perspective Projection, Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm.

Module-IV : Curve Generation and color model:
Curve generation, Bezier and Bspline methods. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong Shading, Gouraud shading, Ray Tracing, Color models like RGB, YIQ, CMY, HSV.

Module-V : Multimedia & Animation:
Text –Types, Unicode Standard ,text Compression, Text file formats, Audio file formats , Image file formats , Digital Video processing, Video file formats. Compression techniques. Animation: Principles of Animation, Computer based animation, 2D and 3D Animation, Animation file formats, Animation software.

Suggested Books:

1. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill.
2. Donald Hearn and M.P. Becker "Computer Graphics" Pearson Pub.
3. Parekh "Principles of Multimedia" Tata McGraw Hill .
4. Maurya, "Computer Graphics with Virtual Reality System " , Wiley India.
5. Pakhira,"Computer Graphics ,Multimedia & Animation",PHI learning.
6. Andleigh, Thakral , "Multimedia System Design " PHI Learning.

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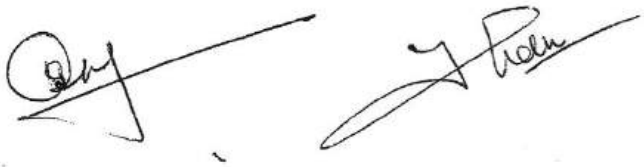
subject : Computer Graphics and Multimedia (CS504)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1:. Explain the basic concepts used in computer Graphics, Multimedia and Animation.
CO2:. Build and apply various algorithms for Scanning, Geometrical Transformations, Area filling & Clipping.
CO3: Develop Curve Generation Algorithm, conclude for Illumination Model and select Color Model.
CO4: Design Computer Graphics application, Animation, Virtual reality and multimedia applications.



Jabalpur Engineering College, Jabalpur
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Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assign ment	End Sem	Lab Work	Total Marks				
CS 505	Artificial Intelligence	70	20	10	30	20	150	3	-	2	4

Module I: Introduction to AI and State Space Search:
Meaning and definition of artificial intelligence, various types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. A* algorithm, AO* algorithms etc., and various types of control strategies..

Module II: Representation of Knowledge:
Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving, inferencing, monotonic and nonmonotonic reasoning.

Module III: Knowledge Inference & Reasoning:
Probabistic reasoning, Baye's theorem, semantic networks scripts schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Module IV: Game Playing and Introduction to NLP:
Game playing techniques like minimax procedure, alpha-beta cut-offs etc, planning, Study of the block world problem in robotics, Introduction to understanding and natural languages processing.

Module V: Introduction to Learning and Neural Network:
Various techniques used in learning, introduction to neural networks, applications of neural networks, common sense, reasoning, some example of expert systems.

Suggested Books:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill.
2. Nelsson N.J., Principles of Artificial Intelligence, Springer Verlag, Berlin.
3. Waterman D.A., A guide to Expert System, Addison Wesley, Reading (Mars).
4. Giarratand & Riley, Expert Systems: Principles and Programming, Thomson.
5. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education.
6. Dan W. Patterson, "Introduction to AI and ES", Pearson Education.
7. Peter Jackson, "Introduction to Expert Systems", Pearson Education.

Suject: Artificial Intelligence (CS505)

Course Outcomes: after completion of course student will be able to:

CO1. Describe fundamental concepts of artificial intelligence such as control strategies, reasoning and learning.

CO2. Explain Neural Network Techniques and various searching techniques and game playing techniques.

CO3. Apply Propositional Logic, Predicate Logic and Fuzzy Logic, min-max algorithms.

CO4. Evaluate problems based on AI's such as 8-Puzzle Problems, hill climbing and various applications of neural networks.

Jabalpur Engineering College, Jabalpur

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(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (E&TC Engg.)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	BT511	HSMC	Professional Ethics	70	20	10	-	-	100	3	-	-	3
2	EC502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	EC503	PCC	Digital Communication	70	20	10	30	20	150	3	-	2	4
4	EC504	PCC	Communication Network & Transmissson Line	70	20	10	30	20	150	3	-	2	4
5	EC505	PCC	Microprocessor & Microcontrollers	70	20	10	30	20	150	3	-	2	4
6	EC407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	EC508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code EC508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	EC502A	Data Structure
2	EC502B	Industrial Electronics
3	EC502C	Bio-Medical Instrumentation

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

DEAN Academic
JEC, Jabalpur (M.P.)

Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

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(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT511	Professional Ethics	70	20	10	-	-	100	3	-	-	3

Module – I HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethics – Service learning – Civics virtue – respect for others – Living peacefully – Caring – Sharing – Honestly – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

Module – II ENGINEERING ETHICS

Sensors of 'Engineering Ethics' – Variety of moral issues – Types of inquiry - Moral dilemmas – Moral Autonomy – Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Module – III ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation - Engineering as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

Module- IV SAFETY, RESPONSIBILITIES AND RIGHT

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – collective Bargaining – Confidentially – Conflicts of interest – Occupational Crime – Professional Rights - Employee Rights – intellectual Property Rights (IPR) – Discrimination

Module- V GLOBLE ISSUES

Multinational Corporations – Environment Ethics – Computer Ethics – Weapons Development – Engineering as Managers – Consulting Engineers - Engineering as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

Outcomes:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS :

1. Mike W.Martin and Roland Schinzinger, " Ethics in Engineering" Tata Mc-Graw Hill New Delhi, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004

References:

1. Charles B. Feddemann, "Engineering Ethics" Pearson Prentics Hall, New Jersey, 2004
2. Charles E. Herris, Michael S. Pritchard and Michael J. Rabins "Engineering Ethics – Concepts and Cases", Learing, 2009
3. John R Boatright, " Ethics and the Conduct of Business" , Pearson Education, New Delhi, 2003
4. Edumund G Seebauer and Robert L Barry, " Fundamental of Ethics for Scientists and Engineers", Oxfoed University Press , Oxford, 2001
5. Laura P. Hartman and joe Desjardins, " Business Ethics: Decision Making for Personal Integrity and Social Responsibility " Mc Graw Hill education India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, " Value Education ", Vethathiri publication , Erode, 2011

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PROFESSIONAL ETHICS (BT511)

Course outcome students will be able to:

CO1 : Understand Human values

CO2 : Apply Engineering Ethics

CO3 : Apply Engineering As social expectation

CO4 : Assess Safety and risks

CO5 : Deep Perception of Global Issues

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC502A	(OEC-I) Data Structure	70	20	10	-	-	100	3	1	-	4

MODULE I
Introduction: Basic Terminology, Data types and its classification, Algorithm complexity notations like big Oh,Theta,Omega. Array Definition, Representation and Analysis of Arrays, Single and Multidimensional Arrays, Address calculation, Array as Parameters, Ordered List and operations, Sparse Matrices, Storage pools, Garbage collection. Recursion-definition and processes, simulating recursion, Backtracking, Recursive algorithms, Tail recursion, Removal of recursion. Tower of Hanoi Problem.

MODULE II Stack, Array Implementation of stack, Linked Representation of Stack, Application of stack: Conversion of Infix to Prefix and Postfix Expressions and Expression evaluation, Queue, Array and linked implementation of queues, Circular queues, D-queues and Priority Queues. Linked list, Implementation of Singly Linked List, Two-way Header List, Doubly linked list, Linked List in Array. Generalized linked list, Application: Garbage collection and compaction, Polynomial Arithmetic.

MODULE III Trees: Basic terminology, Binary Trees, , algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Binary Search Tree (BST), AVL Trees, B-trees. Application: Algebraic Expression, Huffman coding Algorithm.

MODULE IV Internal and External sorting ,Insertion Sort, Bubble Sort, selection sort Quick Sort, Merge Sort, Heap Sort, Radix sort, Searching & Hashing: Sequential search, binary search, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. Symbol Table, Static tree table, Dynamic Tree table.

MODULEVGraphs: Introduction, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

Reference:

1. R. Kruse et al, "Data Structures and Program Design in C", Pearson Education Asia, Delhi-2002
2. ISRD Group; Data structures using C; TMH
3. Lipschutz; Data structure (Schaum); TMH
4. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., N Delhi.
A. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Data Structures Trembley and Sorenson, TMH Publications
6. Pai; Data structure and algorithm; TMH 7. Introduction to Algorithm- Corman, AWL

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Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand data types and its classification, algorithms and its complexity.
CO2	Design & analyze implementation and application of stack.
CO3	Design & analyze binary tree, array and linked representation and applications.
CO4	Analyze various sorting and searching algorithms.
CO5	Design & analysis various types of graphs, matrices and trees.

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC502B	(OEC-I) Industrial Electronics	70	20	10	-	-	100	3	1	-	4

MODULE-I
Power Supplies
Power supply, rectifiers (half wave, full wave), performance parameters of power supplies, filters (capacitor, inductor, inductor-capacitor, pi filter), bleeder resistor, voltage multipliers. Regulated power supplies (series and shunt voltage regulators, fixed and adjustable voltage regulators, current regulator), switched regulator (SMPS), comparison of linear and switched power supply, switch mode converter (flyback, buck, boost, buk-boost, cuk converters).

MODULE-II
Thyristors
Silicon controlled rectifies (SCR), constructional features, principle of operation, SCR terminology, turn-on methods, turn-off methods, triggering methods of SCR circuits, types of commutation, comparison of thyristors and transistors, thermal characteristics of SCR, causes of damage to SCR, SCR overvoltage protection circuit, series and parallel operation of SCRs, Line commutated converters (half wave rectifier with inductive and resistive load, single phase and three phase full wave rectifiers).

MODULE-III
Other members of SCR family
Triacs, Diacs, Quadracs, recovery characteristics, fast recovery diodes, power diodes, power transistor, power MOSFET, Insulated gate bipolar transistor (IGBT), loss of power in semiconductor devices, comparison between power MOSFET, power transistor and power IGBT.

MODULE-IV
Applications of OP-AMP
Basics of OP-AMP, relaxation oscillator, window comparator, Op-comp as rectangular to triangular pulse Converter and vice- versa, Wien bridge oscillator, function generator, frequency response of OP-AMP, Simplified circuit diagram of OP-AMP, power supplies using OP-AMP, filters (low-pass, high pass) using OP-AMP.

MODULE-V
Programmable Logic Controller (PLC)
Functions, applications, advantages and disadvantages of PLC over conventional relay controllers, Comparison of PLC with process control computer system, factors to be considered in selecting PLC, functional block diagram of PLC, microprocessor in PLC, memory, input and output modules (interface cards), sequence of operations in a PLC, status of PLC, event driven device, ladder logic language, simple process control applications of PLC, Programming examples.

References:

1. Bishwanath Paul: Industrial Electronics and control, PHI Learning.
2. Rashid: Power Electronics- Circuits, devices and applications, Pearson Education.
3. Singh and Khanchandani: Power Electronics, TMH
4. Bhimbra: Power Electronics, Khanna Publishers.
5. Moorthi: Power Electronics, Oxford University Press.
6. Webb: Programmable Logic Controllers- Principles and Applications, PHI Learning.
7. Petruzulla: Programmable Logic Controllers, TMH.

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Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Describe performance parameters of various electronic circuits (Power supplies, Regulators, Filters,SMPS)
CO2	Understand principle, construction and operation of SCR
CO3	Compare performance and working of other members of SCR family (Diac, Triac, IGBT, Power MOSFET)
CO4	Apply Op-Amp for designing electronic circuits (Oscillators, Comparator, wave shaping, power supply, filters)
CO5	Analyze functioning of PLC and its comparison with process control computer system.

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC502C	(OEC-I) Bio-Medical Instrumentation	70	20	10	-	-	100	3	1	-	4

MODULE I - PHYSIOLOGY AND TRANSDUCERS

Cell and its structure – Resting and Action Potential – Nervous system: Functional organisation of the nervous system – Structure of nervous system, neurons - synapse –transmitters and neural communication – Cardiovascular system – respiratory system – Basic components of a biomedical system - Transducers – selection criteria – Piezo electric, ultrasonic transducers – Temperature measurements - Fibre optic temperature sensors.

MODULE II - ELECTRO – PHYSIOLOGICAL MEASUREMENTS 9

Electrodes –Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms. Electrical safety in medical environment: shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments

MODULE III - NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound –Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers : pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSRmeasurements .

MODULE IV - MEDICAL IMAGING

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems

MODULE V- ASSISTING AND THERAPEUTIC EQUIPMENTS

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy

TEXT BOOKS

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.

REFERENCES

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.

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Course Outcomes:

CO1	Identify and describe operation of biomedical instrumentation and Transducers
CO2	Analyze design parameter of ECG, EEG.
CO3	Study of non electric parameter measurement.
CO4	Understand various Medical Imaging Techniques
CO5	Study of assisting & therapeutic equipments

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) V Sem. (Electronics & Telecommunication Engg.)
(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC503	Digital Communication	70	20	10	30	20	150	3	-	2	4

MODULE I
Digital transmission of analog signal, sampling theorem, quantization, companding, PAM, PWM, PPM,PCM, DPCM, delta modulation, adaptive delta modulation, delta sigma modulation, bandwidthrequirements of PCM, TDM, noise in PCM, PPM, PWM, DM.

MODULE II
Signalling formats ,base band data transmission in presence of white Gaussian noise , pulse shaping , intersymbol interference , Nyquist theorem for pulse shaping ,raised cosine filters ,digital signalling throughband limited channels ,synchronisation techniques .

MODULE III
Digital modulation formats ASK ,BFSK , PSK , FSK , MFSK , DPSK ,QPSK transmitters, receivers,signals spectrum, bandwidth, constellation diagrams, M-array data communication systems.

MODULE IV
Binary synchronous data transmission, matched filters, errors probability for matched filter receivers,correlated implementation for the matched filters, Coherent and non coherent detection of ASK, PSK,BPSK, FSK.

MODULE V
Optimum receivers and signal space concepts, orthonormal representation of signals, binary signaldetection and hypothesis testing, probability of error calculation, ASK, PSK, FSK. BPSK, MPSK, QAM.Error correction coding.

Text Books:
1. Communication Systems, 4/e, Simon Haykin, John Wiley and Sons.
2. Communication system, A B Carlson, McGraw Hill.

Reference Books:
1. Communication systems, Ziemmer, Tarner, John Wiley and Sons.
2. Analog and digital communication systems, B P Lathi, Oxford University Press.
3. Schaum's outline in analog and digital communication, Hsu, Tata McGraw Hill.
4. Communication systems, Taub, Schilling, Tata McGraw Hill.

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References:

1. J. G. Proakis and M. Salehi: Communication Systems Engineering, Prentice Hall, Pearson Education International.
2. Simon Haykins: Communication Systems, 4th Edition, John Wiley.
3. J. G. Proakis: Digital Communications, Mc Graw Hills
4. B. P. Lathi: Modern Analog and Digital Communication System, Oxford University Press
5. Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand different modulation digital communication.
CO2	Discuss and describe signalling, Nyquist theorem, sampling and noise.
CO3	Generate digital modulation signals for ASK, PSK, FSK and perform their detection.
CO4	Analyze and evaluate different types of filter and coherent or noncoherent detection of different shift keying
CO5	Analyze probability and error calculation in digital communication.

BE V SEM EC
Subject Code – EC-5003
DIGITAL COMMUNICATION

1. To demonstrate Time Division Multiplexing and demultiplexing process using Pulse amplitude modulation signals.
2. To analyze a PCM system. and interpret the modulated and demodulated waveforms for a sampling frequency of 4KHz .
3. To analyze a DPCM system and interpret the modulated and demodulated waveforms for a sampling frequency of 8 KHz.
4. To analyze a Delta modulation system and interpret the modulated and demodulated waveforms.
5. To analyze a FSK modulation system and interpret the modulated and demodulated waveforms.
6. To analyze a PSK modulation system and interpret the modulated and demodulated waveforms.
7. To identify the various encoding schemes for a given data stream.
8. To simulate Binary Amplitude shift keying technique using MATLAB software
9. To simulate Binary Frequency shift keying technique using MATLAB software
10. To simulate Binary Phase shift keying technique using MATLAB software
11. To simulate Quadrature Phase shift keying technique using MATLAB software
12. To simulate Differential Phase shift keying technique using MATLAB software

Jabalpur Engineering College, Jabalpur
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(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC504	Communication Network & Transmission Line	70	20	10	30	20	150	3	-	2	4

MODULE I

Characteristic Parameters of Symmetrical and Asymmetrical Two Port Networks and their Design

Image impedance, iterative impedance, characteristic impedance, propagation coefficient, image transfercoefficient , iterative transfer coefficient, Lattice and Bridged T networks, reactive matching networks,matching techniques, insertion loss, symmetrical and asymmetrical attenuators and their design.

MODULE II

Passive LC Filters

Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters,composite filters, Filter specifications, Butterworth approximation, Chebyshev approximation, ellipticfunction approximation, frequency transformation.

MODULE III

Positive Real Function

LC, RL, RC, and RLC network synthesis, Foster and Cauer network, minimum positive real function,Brune's method, Bott-Duffin method, Synthesis-Coefficient.

MODULE IV

Transmission Line Fundamentals

Lumped parameter equivalent, voltage and current on a transmission line, infinite line, characteristicimpedance and propagation constant, waveform distortion, attenuation and phase equalizers, distortion-less line, loading, liner reflection on a line, reflection coefficient, input and transfer impedances, open circuit and short circuit line, reflection factors, reflection loss, insertion loss, T and π equivalents of a line, location of line fault, construction and design of two wire line and coaxial cable.

MODULE V

Transmission Line at Radio Frequencies

Parameters of transmission line and coaxial cable at radio frequencies, distortion-less line, voltage and current on adistortion-less line, standing waves, standing wave ratio, input impedance of open circuit and short circuit, power and impedance measurement on lines, quarter-wave and half wave line, circle diagram, Smith chart, solution of problems using Smith chart, single and double stub matching . Introduction to microstrip lines and its analysis.

References:

1. Ryder: Networks and Transmission Lines, PHI Learning.
2. Valkenberg: Introduction to Modern Network synthesis, Wiley India.
3. Suresh: Electric Circuits and Networks, Pearson Education.
4. Raju: Electromagnetic field theory and Transmission Lines, Pearson Education.
5. Ganesan: Transmission Lines and Waveguides, TMH.
6. Rao: Electromagnetic Waves and Transmission Lines, PHI learning.

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Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Explain describe characteristic parameters of different types of two port networks.
CO2	Analysis and design passive LC filters.
CO3	Define and Describe positive real function and network synthesis.
CO4	Evaluate transmission line fundamentals.
CO5	Analyze and explain different aspects of line at radio frequencies.

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) V Sem. (Electronics & Telecommunication Engg.)
(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC505	Microprocessor & Microcontrollers	70	20	10	30	20	150	3	-	2	4

Module - I

Von newmann model-CPU, Memory, I/O, System Bus, Memory address register, Memory data register, program Counter, Accumulator, Instruction register, Micro operations, Register Transfer Language, Instruction Fetch, decode and execution, Instruction formats.

Control Unit Organization: Hardwired control Unit, Micro programmed Control Unit, Control Memory, Address Sequencing, Micro instruction formats, Micro program sequencer, Microprogramming.

Memory organization: RAM, ROM, Memory maps, Cache memory, Cache mapping, Associative memory, Virtual memory, Memory management hardware.

Module – II

Introduction to 8085: architecture of 8085, pin configurations, machine cycles and bus timings, Instruction classification and data formats, addressing modes, Data transfer operations, Arithmetic operations, Logic operations, Branch operations. Interrupts; 8085 interrupt process, multiple interrupt and priorities, vectored interrupts, Writing Assembly Language programs.

Module- III

Interfacing: Memory interfacing, Interfacing I/O devices, Memory mapped I/O, Interfacing of 8085 with RAM and ROM, 8279 programmable Keyboard/Display interface, 8255A programmable Peripheral interface, Interfacing keyboard and seven-segment display using 8255A, 8254 programmable Interval Timer, 8259A programmable Interrupt Controller, Direct Memory Access (DMA), 8257 DMA Controller. Basic concept of serial I/O, Standards in serial I/O; RS 232C standard, 8085-serial I/O lines, 8251 USART, interfacing scanned multiplexed displays and Liquid Crystal Displays, Interfacing a matrix keyboard.

Module- IV

Intel 8086 microprocessor: Introduction to 16-bit microprocessor, 8086 architecture, pin functions. Register organization, Instruction Format; Addressing modes of 8086, Minimum and Maximum mode configuration, memory interfacing with 8086 in minimum and maximum mode. Interrupts, Instruction set of 8086; Data Transfer Instruction, Arithmetic Instructions, Branching and Looping Instructions, Flag Manipulation and machine control Instructions, Logical, Shift and Rotate Instructions, String Instructions, Assembler Directives and Operators; Assembly language Programming of microprocessor 8086.

Module- V

Microcontroller: Introduction to micro controller 8051, its architecture, Signal descriptions, Register set, Operational features; Program status word (PSW), memory and I/O addressing by 8051, I/O configuration, Counters and Timers, Interrupts and stack of 8051, Addressing modes and instruction set of 8051.

Reference Books:

1. Microprocessor architecture, Programming and Applications with the 8085 by Ramesh S.Gaonkar
2. Morris Mano, "Computer System Architecture" (PHI).
3. William Stalling, "Computer Organization and Architecture" (PHI).

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4. B B Brey, "The Intel Microprocessors, Architecture, Programming and Interfacing" (PHI)
5. K M Bhurchandi and A K Ray, "Advanced Microprocessors and Peripherals" (Mc-Graw Hill)

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand the fundamental concepts of computer system architecture
CO2	Learn the operation and programming of 8085 microprocessor.
CO3	Illustrate how the different peripherals are interfaced with microprocessor.
CO4	Analyze the architecture and working of 8086 microprocessor.
CO5	Analyze of the working of 8051 microcontroller.

Microprocessor and Microcontroller Lab

List of Experiments:

I. BYTE MULTIPLICATION.
2. WORD MULTIPLICATION
3. PACKED BCD FROM ASCII
4. BCD MULTIPLICATION
5. BCD DIVISION
6. BCD SUBTRACTION
7. SIGNED BYTE TO WORD
8. SCAN STRING FOR CHARACTER
9. IF THEN ELSE IMPLIMENTATION
10. BCD TO HEX (REGTSTER PARAMETER).

List of Experiments:

1. To set up Transmission Line Analyzer for measurements.
2. To set up the standing waves formation on a transmission line and observe their maxima and minima using frequency domain method.
3. To measure the characteristic impedance of transmission lines using frequency domain method and to differentiate between the matched and unmatched lines.
4. To measure the VSWR, reflection coefficient and return loss in a transmission line.
5. To measure the dielectric constant of insulator in the transmission line.
6. To measure the velocity of propagation and wavelength in the given transmission line.
7. To study the attenuation characteristics of signal along a transmission line and observe its variation with frequency. Also calculate the phase constant and propagation constant.
8. To study the effect of reactive loads on transmission lines.
9. To study the difference between lossy and loss less line.
10. To study the physical dimensions of transmission line and estimation of characteristic impedance.
11. To study behavior of infinite and short lines.
12. To study the operation of Balun transformer.
13. To study the loading of transmission lines and estimate the cut off frequency of a loaded line.
14. To study the use of coaxial lines as tuned circuits and delay lines.
15. To study the input and output impedance of any RF circuits and match it to 50/75 ohms.
16. Simulation of various filters.

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Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Electrical Engg.)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	BT521	HSMC	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3
2	EE502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	EE503	PCC	Electrical Machine - II	70	20	10	30	20	150	3	-	2	4
4	EE504	PCC	Power Electronics	70	20	10	30	20	150	3	-	2	4
5	EE505	PCC	Control System	70	20	10	30	20	150	3	-	2	4
6	EE407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	EE508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code EE508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	EE502A	Power System-II
2	EE502B	Electrical Energy Conversation & Auditing
3	EE502C	Computational Electromagnetic

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit

1 hour Tutorial (T) = 1 credit

2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

DEAN
Academic
JEC, Jabalpur (M.P.)

Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (CE/EE/IT/IP) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT521	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3

Module - 1

Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Module - 2

Market Structure Perfect Competitions Imperfect - Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.
Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break - Even Analysis.

Module - 3

Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Module - 4

Management Aspects, Functions of Management, Project Management, Value Engineering, Project Evaluation, Work simplification – process charts and flow diagrams, Production Planning, Decision Making.

Module - 5

Inventory Control: Inventory, Cost, Deterministic Models
Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson

Course Code : BT521
Course Category : HSMC
Course Name : **Engineering Economics and Management**

After completion of this course students will be able to-

CO1: Understand the key management concepts, principles and contribution by different Management thinkers.
CO2: Analyze and design organization for effective management.
CO3: Application of modern management techniques.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (Electrical Engineering) Semester: V

(w.e.f. July 2019)

EE 502 (OPEN ELECTIVE – I)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
EE502A	Power System - II	70	20	10	-	-	100	3	1	-	4

Module I

Overhead Line Insulators: Types, Insulator material, failure of insulator, testing of insulator, string efficiency, arcing horn, grading ring, preventive maintenance.

Cables: Classification, construction and characteristics of different types. Insulation resistance and capacitance, grading (capacitance and inter sheath), phenomenon of dielectric losses, dielectric stress and sheath loss in cables. Selection of cables

Module II

Compensation in Power Systems: Introduction, Concepts of Load compensation, Loadability characteristics of overhead lines, Uncompensated transmission line, Symmetrical line, Radial line with asynchronous load, Compensation of lines.

Power Factor Improvement: Disadvantages and Causes of low power factor, Methods of power factor improvement. Economics associated with power factor.

Module III

Travelling Waves: Production of traveling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves.

Corona: Phenomenon and theory of corona formation, Calculation of potential gradient, Critical Voltages, Radio and Television interference,

Module – IV

Per Unit Representation of Power Systems: The one line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

Symmetrical Faults: Fault calculations, purpose of fault analysis, short circuit capacity, star-delta and delta-star transformation, Transient is a series R-L circuit,

Module – V

Symmetrical Components and Unsymmetrical Faults: Fortesque's Theorem, Significance of positive, negative and zero sequence components. Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks,

Course Code : **EE502 A**
Course Category : **OEC**
Course Name : **Power System - II**

After completion of this course students will be able to-

CO1: Evaluation and design of power system components.
CO2: Analyze and test the faults in power system.
CO3: Calculation of parameters associated with electrical power.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (AICTE) V Sem. (Electrical Engineering)

(w.e.f. July 2019)

EE502 (OPEN ELECTIVE-I)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
EE502C	Computational Electromagnetic	70	20	10	-	-	100	3	1	-	4

Module-I: Introduction to Numerical Methods: Electromagnetic Problems, Basic Numerical Methods, Solution of Algebraic Equations, Accuracy Consideration and Richardson Extrapolation, Examples

Module-II: Finite-Difference Method: Finite-Difference in One Dimension, A One Dimensional Differential Equation, Finite-Difference in Two Dimensions, Two Dimensional Capacitance Problem, Open Regions, Generalizations, Determination of Eigen values in One Dimension, Waveguide Mode Example, Numerical Evaluation of the Determinant, Iterative Solution Methods

Module-III: Finite-Difference Time-Domain Method: Wave Equation in One Spatial Dimension, Time Quantization, Initial Conditions, Waves in Two and Three Spatial Dimensions, Maxwell's Equations.

Finite Element Method: Basic Concept of Finite Elements, Finite Elements in One Dimension, Linear Interpolation for Isosceles Right Triangles, Square Elements, General Triangular Elements, High Order Interpolation with Triangles, Nodal Expansions and the weak Formulation, Time Dependent Variables.

Module-IV: Method of Moments: Linear Operators, Approximation by Expansion in Basis Functions, Determination of the parameters, Differential Operators, Integral Operators, Pulse Functions, Parallel Plate Capacitor in Two Dimensions, Analysis of Wire Dipole Antenna, Comparison of FDM, FDTD, FEM, and MoM. Hybrid Computational Methods

Reference Books:

1. Analytical and Computational Methods in Electromagnetics, By R. Garg, Artech House Publication
2. Computational Methods for Electromagnetics and Microwaves, By R.C Booton, Jr, John Wiley & Sons
3. Computational Methods for Electromagnetics, By A. F. Peterson, S. L. Ray, and R. Mittra, IEEE Press
4. The Finite Element Method in Electromagnetics, By J. M. Jin, John Wiley & Sons
5. The finite difference time domain method for electromagnetis, By K. S. Kunz & R. J. Luebbers, CRC Press 6. Field Computation by Moment Methods, By R. F. Harrington, Macmillan

EE502 Computational Electromagnetic

Course Outcomes

CO1. Identify conventional and state-of-the-art computational electromagnetic techniques, covering analytical, numerical and asymptotic technique for solving complex electromagnetic problem.

CO2. Apply electromagnetic wave theories and tools for the electromagnetic application of wave propagation , radiation , scattering and in particular wireless communication.

CO3. Learn & Identify the basics of Finite difference, finite difference Time domain & finite element methods for solving Maxwell equation both static and electromagnetic.

CO4. Identify & problem solving for Application of electromagnetic by different methods.

Jabalpur Engineering College, Jabalpur

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B.Tech. (Electrical Engineering) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
EE503	Electrical Machines - II	70	20	10	30	20	150	3	-	2	4

Module – I : Basic Principles of Three Phase Induction Motor :

Constructional details, types – squirrel cage, slip ring, principle of operation, production of rotating magnetic field, speed / slip, rotor current and voltage, torque developed, condition for max. torque, torque/slip and torque/speed characteristics, induced emf in stator and rotor winding.

Module – II : Performance Analysis of Three Phase Induction Motor :

Rotor circuit model, stator circuit motor, complete equivalent circuit, referred to stator, approximate equivalent circuit, power flow diagram, circle diagram, no load & block rotor test, starters used with three phase induction motor- DOL, auto-transformer , star delta starter, effect of space harmonics on performance of three phase induction motor, cogging and crawling, different methods of speed control, pole changing, stator voltage control, variable frequency control.

Module – III : Synchronous Machine (Alternator)

Constructional details, advantages of rotating field, excitation system, EMF equation, armature winding coil span/pitch factor, distribution or breadth factor, armature leakage reactance, armature reaction in synchronous machine.

Synchronous impedance, equivalent circuit and phasor & equivalent Ckt. diagram of synchronous generator, voltage regulation, emf method, mmf method, ZPFC/potier delta method, two reaction theory, torque angle characteristic of salient pole synchronous machine determination of Xd & Xq, parallel operations of alternator, process of synchronization, significance of synchronizing power coefficient, transient condition of alternator, SCR cooling of synchronous machine.

Module – IV : Synchronous Machine (Motor)

Construction, principle of operation, main features of synchronous motor, torque developed, power flow equation for synchronous motor, phasor diagram, effect of varying field current, V & inverted V curves, starting of Synchronous motor, Hunting or phase swinging, Damper Winding, application of synchronous motor.

Module – V : Fractional kW Motors :

Shaded Pole Motor, Commutator motor, AC series motor, Universal motor, Repulsion motor, Servo motors, stepper motor.

Course Code : **EE503**
Course Category : **PCC**
Course Name : **Electrical Machines - II**

After completion of this course students will be able to-

CO1: Analyze the performance of three phase induction motor in details.
CO2: Evaluate the parameters and performance on polyphase synchronous machines.
CO3: Explain application of special electric motors.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (Electrical Engineering) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
EE504	Power Electronics	70	20	10	30	20	150	3	-	2	4

Module I POWER SEMICONDUCTOR DEVICES

Power Diodes, transistors, power MOSFET, IGBT, thyristors, characteristics, two- transistor equivalent model, turn on & off, techniques thyristor performance parameters, protection circuits & thermal design of thyristors, commutation techniques-forced and natural.

Module II CONTROLLED RECTIFIERS

Principle of phase controlled converter operation, single-phase half wave, Full wave and semi converters. Three phase half wave, Full wave and semi converters Dual converters, power factor improvement, Symmetrical angle control, pulse width modulation control, effects of load and source inductance, Design of converter circuits, regulated DC power supplies.

Module III AC VOLATGE CONTROLLERS

Principle of phase control, single phase AC Voltage controllers with resistive and inductive loads. Three phase AC voltage controllers with resistive & inductive loads, Industrial applications of AC controllers. Unity power factor controller, design of AC controller.
Cyclo converter: Principles of operation of single and three phase cyclo converters.

Module IV DC CHOPPER

Principles of step down & step up choppers, operation with R-L load, four quadrants choppers, thyristor chopper circuit, impulse commutation, effects of source inductance, chopper circuit design, switched mode power suppliers, and regulators.

Module V INVERTER CIRCUITS

Principle of operation of inverter, single phase & three phase voltage source, inverter magnitude of voltage & harmonics control. forced commutation techniques, , current source inverters, inverter circuit design.

References:

1. M.H.Rashid," Power Electronics Circuit, Devices & Applications". Person publication,1993.
2. M.Ramsmoorthy, "An Introduction to transistor their Applications", affiliated East-West Press.
3. P.C.Sen "Power Electronics", TMH publication.
4. M.D.Singh, K.B.Khanchandani," Power Electronics", TMH, Delhi 2001.
5. Chakravarti A.," Fundamental of Power Electronics and Drives", Dhanpat Rai & Co.
6. Dr P.S. Bhimra," Power Electronics", Khanna Publication.

7. Vedam Subramanyam," Power Electronics" New Age International Revised II ed.2006.
8. Randal Shaffer, "Fundamental of Power Electronics with MATLAB learning" 2008.

List of Experiments :

1. SCR characteristics
2. TRIAC characteristics.
3. MOSFET characteristics
4. IGBT characteristics
5. To study the different triggering circuits for thyristor.

(a) Resistor triggering circuit. (b) R-C triggering circuit (c) UJT triggering circuit.

6. AC voltage control by using TRIAC & DIAC
7. Analysis of 1-pulse & 2-pulse converter with R and L load.
8. Analysis of three phase semi converter & full converter with R and R-L load.
9. Analysis of single phase dual converter.
10. Analysis of single phase cycloconverter.
11. Analysis of Impulse commutated chopper.
12. Series & parallel inverter
13. Speed control of single phase induction motor.

Course Code : EE504
Course Category : PCC
Course Name : Power Electronics

After completion of this course students will be able to-

CO1: Ability to illustrate the performance and characteristics of various power semiconductor devices.
CO2: Analysis of various power electronic circuits for single phase and three phase power supply.
CO3: Design and operation of power electronic circuits for various loads and supply.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (Electrical Engineering) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
EE505	Control System	70	20	10	30	20	150	3	-	2	4

Module-I

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), tachogenerators, power amplifier, stepper motors.

Module-II

Time-domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants, Feedback control actions: Proportional, derivative and integral control.

Module-III

Concept of stability, Necessary condition for stability, Routh - Hurwitz Stability criterion, Relative stability analysis, Root locus technique.

Module-IV

Frequency response analysis and stability in frequency domain: Correlation between time and frequency response analysis, Polar plots, Bode plots, Effect of adding pole and zeros, Nyquist stability criterion, gain margin and phase margin, Relative stability from Nyquist plot, Frequency domain compensation, lead, lag, lag-lead compensation.

Module-V

State space analysis: Concept of state, state space representation of systems, Block diagram for state equation, Transfer function decomposition, Solution of state equation, Concept of controllability and observability.

REFERENCES:

- I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
- K. Ogata, Modern Control Engineering, PHI.
- B.C. Kuo, Automatic Control systems, PHI
- Gopal M., Control System : Principles & Design, TMH.
- N.K. Sinha, Control Systems, New Age International
- Stefani, Shahian, Savant, Hostetter – "Design of feed back control System's", Oxford Press

- B.S.Manke, "Linear Control System with MATLAB Application", Khanna Pub.

LIST OF EXPERIMENTS :

- Time response of second order system.
- Characteristics of synchros.
- Effect of feedback on servomotors.
- Determination of transfer function of A-C servomotor.
- Determination of transfer function of D-C motor.
- Formulation of PI & PD controller and study of closed loop responses of I^{st} and II^{nd} order dynamic systems.

Course Code : **EE505**
Course Category : **PCC**
Course Name : **Control System**

After completion of this course students will be able to-

CO1: Model the electrical, mechanical and hydraulic system to obtain their transfer function.
CO2: Determination of time response and frequency response of first and second order systems and steady state error.
CO3: Estimate stability using Routh-Hurwitz criteria and state space analysis.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (Electrical Engineering) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
EE407	Industrial training / Internship evaluation	-	-	-	60	40	100	-	-	2	1

The student shall go to an Industry at the end of fourth Semester during summer break and shall prepare a report on the Practical Training undergone there. He has to present the report in fifth semester and assessment will be done by committee of two members (Headed by H.O.D. of the Department).

Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Industrial & Production Engg.)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	BT521	HSMC	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3
2	IP502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	IP503	PCC	Tool Engg. & Machine Tools	70	20	10	30	20	150	3	-	2	4
4	IP504	PCC	Metal Cutting Science	70	20	10	30	20	150	3	-	2	4
5	IP505	PCC	Work Study & Ergonomics	70	20	10	30	20	150	3	-	2	4
6	IP407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	IP508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code IP508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	IP502A	Metrology & Quality Control
2	IP502B	Sequencing & Scheduling
3	IP502C	Productivity Management

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

IND & PRODUCTION Engg. Department J.E.C. Jabalpur

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. (CE/EE/IT/IP) (Semester-V) AICTE

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT521	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3

Module -1

Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Module -2

Market Structure Perfect Competitions Imperfect- Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break-Even Analysis.

Module -3

Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Module -4

Management Aspects, Functions of Management, Project Management, Value Engineering, Project Evaluation, Work simplification – process charts and flow diagrams, Production Planning, Decision Making.

Module -5

Inventory Control: Inventory, Cost, Deterministic Models

Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

16/7/19

IND & PRODUCTION Engg. Department J.E.C. Jabalpur

Course Code : BT521
Course Category : HSMC
Course Name : **Engineering Economics and Management**

After completion of this course students will be able to-

CO1: Understand the key management concepts, principles and contribution by different Management thinkers.
CO2: Analyze and design organization for effective management.
CO3: Application of modern management techniques.

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech. Industrial &Production Engineering (V-Semester) AICTE

Credits: 4	IP-502 A	Metrology &quality control	L: 3, T:1,P:0

Course Objective:

- To learn about various measurement tools and their applications.
- To explain Statistical Process Control.
- To learn about Process Capability and Sampling Plans.

Course Content:

METROLOGY & QUALITY CONTROL
(IP-502)

Module 1

General concept of measurement: Definition-standards of measurement, Errors in measurement, Limit-gauging, various systems of limits, Fits and tolerance, Interchangeability, Tolerance analysis in manufacturing and assembly, ISI and ISO system. Basic principles and design of standards of measuring gauges, Types of gauges and their design, Taylors Principal, Accuracy and precision, Calibration of instruments, Principals of light interference, Interferometer, Measurement and calibration, Tolerance analysis in manufacturing and assembly.

Module 2

Linear and angular measurements: Slip gauges, Micrometers, Dial gauges, Surface plates, Comparators Mechanical, Electrical, Pneumatic and optical comparators, Angular measuring instruments-Sine bar, Angle gauges, Sprit level, Autocollimators, Clinometers, Measurement of straightness, flatness, squareness, roundness, and symmetry Inspection of screw threads and gears.

Module 3

Measurement of surface finish and measuring machines: Surface finish-Definitions, types of surface texture, Surface roughness measurement methods, Visual inspection, Surface roughness blocks, Averaging Instruments, Profile-meters, Pneumatics and replica, Measurement of run out and concentricity, Length bar measuring machine, Optical projection, Comprators, Tool makers microscope, Inspection of Screw threads and gears, Measurement of straightness, flatness, roundness, squareness and symmetry.

Module 4

Statistical Process Control: Basic Discrete and Continuous distributions, Measures of central tendency, Variability and shapes, Sampling, Size and Central value theorem, Control chart structure, Process plotting and stability, Study of out-of-control evidences, Defect detection and prevention. Use of control charts in evaluating past, present and future trends; Variables and Attributes. Concept of Control Charts, Types of Control Charts, Control Charts for Attributes, p Chart, np Chart. c Chart u Chart, Control Charts for Variables x Chart, R Chart.

Module 5

Process Capability and Sampling Plans: Introduction, Variation in Process, Types of Variations. Factors Contributing Variations ,Analysis of Process Capability, Acceptance sampling, Advantages and limitations of sampling inspection, Sampling methods, Single, Double and Multiple sampling plan, Operating Characteristic curve, Producer Risk and consumer Risk. Quality indices for acceptance sampling plans, Average outgoing quality limit (AOQL), Characteristics of OC curve, Characteristics of good sampling plan,.

References:

1. ASTE.Handbook of Industrial Metrology.PHI Publications.
2. Jain.R.K.Engineering Metrology. khanna Publications.
3. Gupta.I.C.A Text book of Engineering Metrology.Dhanpat Rai and Sons.
4. Galye.G.N.Metrology for Engineers.Elbs Publications.
5. Rajput.R.K.Engineering Metrology and Instrumentation.S.K.Kataria&Sons.

Course Outcomes:

At the completion of this course, students should be able to

CO1	calculate fits and Tolerance.
CO2	use linear and angular measuring instruments.
CO3	understand surface roughness measurement methods.
CO4	evaluate control charts for variables and attributes.
CO5	prepare Single, Double and Multiple sampling plan,

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	3	1	1	0	0	0	0	1
CO2	1	0	1	2	3	1	0	0	0	0	0	0
CO3	0	0	1	2	2	0	1	1	0	0	0	0
CO4	0	2	2	1	3	1	0	1	1	0	0	1
CO5	1	1	2	2	2	2	1	0	2	1	1	1

NO 3 PRODUCTION
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I.E.C., Jabalpur

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech. Industrial &Production Engineering (V-Semester) AICTE

Credits: 4	IP-503	Tool engineering and machine tools	L: 3, T: , P:2

Course Objective:

- Provide knowledge about Basic Features and Kinematics of Machine Tools.
- Explain design of metal working tools.
- Explain principle and Design of jigs and fixtures.
- Explain Gear generation process Gear finishing process.
- Mould Design and Acceptance Tests.

Course Content:

TOOL ENGINEERING & MACHINE TOOLS
(IP-503)

Module 1

Basic Features and Kinematics of Machine Tools: Features of basic machine tools, Construction and operation, types of machine tools, Machine tools motion, and transmission-rotation in to rotation, Rotation in to translation, Kinematical-structures of machine tools, Elementary, Complex and compound structure.

Module 2

Design of Metal Working Tools: Design of press working tools, Press working terminology, Types of press working dies, Principle of metal shearing in press working operation, Design of Shearing, Piercing and Blanking dies, Press tool shearing operations, Bending, Forming and Drawing dies, Embossing, Coining and Spinning operations, Metal working defects.

Module 3

Design of jigs and fixtures: Principles of Jigs and Fixture Design, Locating and Clamping, Principles of location, Locating devices, Mean Locators or centralisers, Types of clamping devices, Strap clamps, Hinged clamps, C clamps, Quick acting clamps, Elements of Jigs, Types of Jigs, Drilling jigs, Types of drilling jigs, Milling Fixture, Elements of Milling Fixtures, Classification of Milling Fixtures, Turning Fixtures, Grinding and Broaching Fixture, Materials for Jigs and Fixtures, Usefulness of Jigs and Fixtures.

Module 4

Gear Cutting: Gear generation process: Gear Shaping, Gear Hobbing, Gear finishing process: Gear Shaving, Gear Burnishing, Gear Grinding, Gear Lapping, Gear Honing.

Broaching: Broaching machines, Broach terminology, Types of Broaches, Method of Broaching. **Thread production methods**: Thread chasing, Thread Rolling, Die Threading, Thread Tapping, Thread Milling, Thread Grinding.

Module 5

Polymer and Composits: Introduction, Plastic processing, Injection, Compression and Blow moulding, Extrusion, calendaring and thermoforming, moulding of composites, Dies and mould design for plastics and rubber parts.

Powder Metallurgy: Production of metal powders, Compacting and Sintering.

Mould Design and Acceptance Tests: Common Instruments used in alignment tests, Test procedures, Installation and Leveling, Testing the quality of Grinding and Bearing surfaces, Testing the main Spindle for running, Axial slip, Alignment between two axes, Parallism between an axis and a surface.

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References:

1. Mehta. N.K. Machine Tool Design and Numerical Control.TMH.Publications.
2. Sen. G.C., Bhattacharya. A., Principles of Machine Tools. New Central Book Publications.
3. Donaldson. Tool Design. TMH.Publication.
4. Jain. K.C. A Text Book of Production Engineering PHI. Publication.
5. Juneja, Sekhon & Seth. Fundamentals of Metal Cutting and Machine Tools. New Age Publications.
6. Sharma.P.C. Production Engineering. S.chand Publications.

TOOL ENGINEERING & MACHINE TOOLS LAB
(IP-503)

List of Experiments

1. Draw Kinematical-structures of machine tools.
2. To study Complex and compound structure of machine tools.
3. To study Principle of metal shearing in press working operations.
4. Design of Shearing, Piercing and Blanking dies.
5. Jigs and Fixture Design.
6. To study Gear generation process.
7. To study various Performance parameters of Thread generation methods.
8. To study various methods of Powder Metallurgy

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain about Basic Features and Kinematics of Machine Tools.
CO2	Design metal working tools.
CO3	Design jigs and fixtures.
CO4	Explain Gear generation process Gear finishing process.
CO5	To do Mould Design and Acceptance Tests

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	0	0	1	0	1	1
CO2	2	2	3	0	3	1	0	1	0	1	0	1
CO3	1	1	3	1	3	0	1	0	0	0	0	1
CO4	1	1	0	0	3	0	0	0	0	0	0	1
CO5	1	0	3	1	3	0	0	0	0	0	0	1

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech. Industrial &Production Engineering (V-Semester) AICTE

Credits: 4	IP-504	Metal cutting science	L: 3, T: 1, P:2

Course Objective:
To learn about various machine tools and their applications

Course Content:

METAL CUTTING SCIENCE
(IP-504)

Module 1

Principles of metal cutting: Geometry of single pointed cutting tools, types of cutting tool, tool signature & nomenclature, Orthogonal and Oblique cutting, Measurement of cutting force, Merchant circle and force analysis of single point orthogonal cutting, Cutting tool material, Mechanism of cutting and chip formation, Types of chips, Tool Failure,.

Module 2

Tool Life and Thermal aspect of cutting: Heat distribution, Shear plane temperature in orthogonal cutting, Determination of tool temperature, Tool life equation, Effect of process parameters on tool life, Tool life tests, Mechanism of tool wear, Types of tool wear, Economics of Machining Process, Machinability.

Module 3

Cutting Fluids: Types of Cutting Fluid, Composition of Cutting Fluid, Selection of Cutting Fluids, Method of applying cutting fluid, Benefits,

Lathe: Lathe- specification, Components & accessories, various operations on lathes, Lathe parameters, Cutting speed, Depth of cut, Capstan & Turret lathes, tool layout, Machining time calculation, Methods of Screw production.

Module 4

Milling: Working principle, classification, Specification, Accessories & Attachment, Milling Cutters, Elements of plain milling cutter, up milling and down milling, Thread milling, Universal dividing head, Indexing Methods: Direct Indexing, Plain or Simple Indexing, Compound Indexing, Differential Indexing, Angular Indexing, Machining time calculation.

Module 5

Shapers: Classification and Specifications, Principle parts, Quick return mechanism, Shaper operations, Cutting speed, Feed, Depth of cut, Machining time calculation.

Drilling: Classification & specification of Drilling Machines, Work holding and Tool holding devices, Drilling Machine Operations, Machining time.

References:

1. Groover MP; Fundamentals of modern manufacturing; Wiley India
2. Kaushish JP; Manufacturing processes; PHI
3. Boothroyd G, Knight WA; Fundamentals of machining and machine tools; CRC-Taylor and francis
4. Munoz J and Oswald PF; Manufacturing processes and systems; Wiley India;
5. Boston; Metal Processing.
6. Hazra Chowdhary; Workshop Technology.II
7. Lindberg – Materials & Processes of Manufacture.
8. Work shop technology by Raghuvanshi-Vol-II
9. Production Processes by HMT

IND & PRODUCTION Engg. Department J.E.C., Jabalpur

Course Outcomes:

At the completion of this course, students should be able to

CO1	Learn to build a job on lathe machine.
CO2	Method of applying cutting fluid.
CO3	Understand the working and operations of milling machine.
CO4	Knowledge of shaper machines and operations.
CO5	Analyze Tool Wear, its variables and estimation of tool life.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	1	2	1	1	1	0	0	0	0	1
CO2	0	0	1	1	1	1	0	0	0	0	0	0
CO3	0	0	1	2	2	0	1	1	0	0	0	0
CO4	0	0	2	1	0	1	0	1	1	0	0	1
CO5	1	1	2	2	1	2	1	0	2	1	1	1

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Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.TECH Industrial &Production Engineering (V-Semester) AICTE

Credits: 4	IP-505	Work study and ergonomics	L: 3	P: 2

Course Objective:

- To be familiar with work study procedure and its application
- To learn about human factor engineering.
- To learn about basic procedure of method study.
- To be familiar with Job Evaluation process and Merit Rating.

Course Content:

WORK STUDY & ERGONOMICS
(IP-505)

Module I

Work Study: Purpose of Work Study, Objectives, Procedure, and Applications of Work Study, Prerequisites of conducting Work Study, the human factor in the application of Work Study, The influence of working condition on work study.

Human Factor Engineering: Objective of Ergonomics, Applications of Ergonomics, Man-Machine System, Characteristics of Man-Machine System, Classification of Man-Machine System, Working environment, Workplace design.

Module II

Method study: Method Study definition and objective of Method Study, Basic procedure, Process Analysis, Process Chart Symbol. Selection of job, Various Recording techniques like Outline Process Charts, Flow Process Charts, Man Machine Charts, Two handed Process Charts, String diagram, Flow diagram, Multiple activity chart, Simo, Cyclographs and Chrono-cyclographs, Critical examination, Development, Installation and Maintenance of improved method, Principles of Motion Economy ,Therbligs, Micro motion study, Memo motion study.

Module III

Work Measurement: Introduction & Definition, Objectives and basic procedure of Work Measurement, Time study, basic procedure, equipments needed, Methods of Measuring time, Selection of jobs, Breaking a job into Elements, Numbers of Observations, Performance Rating, Rating Procedure Allowances, Calculation of Standard Time, Predetermined motion time system (PMTS), Method time measurement (MTM).

Module IV

Job Evaluation and Merit Rating: Concept and objectives of Job Evaluation and Merit Rating, Job Evaluation Methods, Different Methods of Merit Rating.

Wage Incentive Plans: Requirement, Objectives of Wage Incentive Plans, Types of Wage Incentive Plans.

Work Sampling: Basic procedure, determining time standards by Work Sampling, Procedure for selecting random observations, Work Sampling errors.

Module V

Display Systems and Controls: Display- Types of display, Visual display, Quantitative display, Qualitative display, Representational display, Alphanumeric display, Types of controls, Selection of control, Control resistance, Relationship between controls and displays, Use of anthropometric data.

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Reference:

1. ILO; work-study; International Labour Organization
2. Barrnes RM; Motion and Time Study, Wiley pub
3. Currie RM; Work study; BIM publications
4. Megaw ED; Contemporary ergonomics; Taylor & Fracis
5. Mynard; Hand book of Industrial Engineering.

WORK STUDY & ERGONOMICS LAB
(IP-505)

LIST OF EXPERIMENTS :

2. Preparation of two handed process chart.
3. Preparation of Multiple Activity chart.
4. Preparation of flow process charts on activities in Workshop/ Laboratory/Office .
5. To conduct time study of the bulb holder assembly operation for the existing method .
6. Determination of time standard for a given job using stopwatch time-study.
7. Preparation of man-machine charts for an existing setup and development of an improved process.
8. Determination of time by MTM.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Understand work study procedure application and its objective.
CO2	Able to prepare flow process chart, Man Machine Charts, Two handed Process Charts, String diagram, Flow diagram
CO3	Understand Job Evaluation and Wage Plans & Industrial Legislation.
CO4	Use Applications of work Measurement and work sampling.
CO5	To carry out micro motion and memo motion analysis.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	2	1	0	0	1	0	1	0
CO2	1	3	2	1	2	3	0	1	0	1	0	0
CO3	1	2	1	1	2	1	1	0	0	0	0	1
CO4	1	2	2	1	2	2	0	0	0	0	0	0
CO5	1	1	1	1	2	3	0	0	0	0	0	1

Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Information Technology)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	BT521	HSMC	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3
2	IT502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	IT503	PCC	Computer Network	70	20	10	30	20	150	3	-	2	4
4	IT504	PCC	Operating System	70	20	10	30	20	150	3	-	2	4
5	IT505	PCC	Data Base Management System	70	20	10	30	20	150	3	-	2	4
6	IT407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	IT508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code IT508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	IT502A	Automata and Compiler Design
2	IT502B	Computer Graphics and Multimedia
3	IT502C	Management Information System

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

DEAN Academic
JEC, Jabalpur (M.P.)

Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

Bachelor of Engineering (CE|EE|IT|IP) Semester: V

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT521	Engineering Economics and Management	70	20	10	-	-	100	3	-	-	3

Module - 1

Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Module - 2

Market Structure Perfect Competitions Imperfect - Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break - Even Analysis.

Module - 3

Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Module - 4

Management Aspects, Functions of Management, Project Management, Value Engineering, Project Evaluation, Work simplification – process charts and flow diagrams, Production Planning, Decision Making.

Module - 5

Inventory Control: Inventory, Cost, Deterministic Models

Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson

Course Code : BT521
Course Category : HSMC
Course Name : **Engineering Economics and Management**

After completion of this course students will be able to-

CO1: Understand the key management concepts, principles and contribution by different Management thinkers.
CO2: Analyze and design organization for effective management.
CO3: Application of modern management techniques.

B.Tech. FIFTH SEMESTER (INFORMATION TECHNOLOGY)						
IT 502 Copin Elective-I COURSE CONTENT (AICTE July 2019)						
SUB. CODE	**SUB. NAME**	**L**	**T**	**P**	**MAX. MARKS**	**CREDITS**
IT 502A	**Automata and Compiler Design**	3	1	–		4

Module I: Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), Equivalence of NFA and DFA, Minimization of Finite Automata, Regular expression, Regular Grammar, Regular languages, closure properties of Regular languages.

Module II: Context free grammars, Properties of context free languages. Pushdown Automata: Non deterministic push down automata: Definition of a push down automata, the language accepted by a push down automata, Push down automata for context free languages, CFG's for PDA, Deterministic Push down automata and Deterministic Context free languages.

Module III: Compiler Structure: Compilers and Translators, Various Phases of Compiler. Lexical Analysis: The role of Lexical Analyzer, A simple approach to the design of Lexical Analyzer, Implementation of Lexical Analyzer. The Syntactic Specification of Programming Languages: CFG, Derivation and Parse tree, Ambiguity, Capabilities of CFG. Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive Descent Parsers, Predictive Parsers, Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR)

Module IV: Intermediate Code Generation: Different Intermediate forms: three address code, Quadruples & Triples. Syntax Directed translation mechanism and attributed definition. Translation of Declaration, Assignment control flow, Boolean expression, Array References in arithmetic expressions, procedure calls, case statements, postfix translation.

Module V: Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management. Code Optimization and Code Generation: Local optimization, Loop optimization, Peephole optimization, Basic blocks and flow graphs, DAG, Data flow analyzer, Machine Model, Order of evaluation, Register allocation and code selection

References:-

- Louden, "Compiler construction", Cengage learning .
- Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa.
- A.V. Aho, R. Sethi and J.D Ullman, "Compiler: principle, Techniques and Tools", AW.
- Michal Sipser, "Theory of Computation", Cengage learning.
- H.C. Holub, "Compiler Design in C", Prentice Hall Inc.
- Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
- K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation",PHI.

List of Experiment

1. Write a program for executing the Deterministic Finite Automata (DFA). The program should able to accept an input string, and able to result as ACCEPTED/NOT ACCEPTED. Design a DFA which accepts input string only if the pattern e.g. 'abc', is available in the input string. Example : Pattern "abc" I/P String : "xyabcp" ACCEPTED I/P String : "abxsc" NOT ACCEPTED I/P String : "abc" ACCEPTED
2. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
3. Write a C program to identify whether a given line is a comment or not.
4. Write a C program to recognize strings under 'a', 'a*b+', 'abb'.
5. Write a C program to test whether a given identifier is valid or not.
6. Write a C program to simulate lexical analyzer for validating operators.
7. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools
8. Write a C program for implementing the functionalities of predictive parser for the mini language specified in Note 1.
9. Write a C program for constructing of LL (1) parsing.
10. Write a C program for constructing recursive descent parsing.
11. Write a C program to implement LALR parsing.
12. Write a C program to implement operator precedence parsing.
13. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.

Automata and Compiler Design (IT 502A)

CO 1. Illustrate the concept of Automata and Compiler Design and minimization of finite Automata.
CO 2. Formulate using CFC's for PDA and NPDA concept also define push down Automata.
CO 3. To understand compiler structure and basic parsing techniques.
CO 4. Classify intermediate Code Generation Techniques.
CO 5. Explain Run time memory management and data flow analyzer machine model.

B.Tech. FIFTH SEMESTER (INFORMATION TECHNOLOGY)						
IT 502 (Open Elective-I) COURSE CONTENT (CBGS w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 502 B	Computer Graphics & Multimedia	3	1			4

Module-I

Introduction to raster scan displays, Pixels, frame buffer, Vector & Character generation, random scan systems, Graphics Primitives, Display devices, Display file structure, Scan Conversion techniques, line drawing: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms. Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms

Module-II

2D transformation: Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogenous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping, Cohen Sutherland, Midpoint Line clipping algorithms, Polygon Clipping: Sutherland –Hodgeman, Weiler-Atherton algorithms.

Module-III

3D transformations: translation, rotation, scaling. Parallel & Perspective Projection,Types of Parallel & Perspective Projection. Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painters algorithm, Z-buffer algorithm. Curve generation, Bezier and B-spline methods.

Module-IV

Basic Illumination Model, Diffuse reflection, Specular reflection, Phong Shading Gourand shading, ray tracing, color models like RGB, YIQ, CMY, HSV.

Module-V

Multimedia System: An Introduction, Multimedia hardware, Multimedia System Architecture. Data & File Format standards. i.e RTF, TIFF, MIDI, JPEG, DIB, MPEG,Audio: digital audio, MIDI, processing sound, sampling, compression. Video: Avi, 3GP,MOV, MPEG , compression standards, compression through spatial and temporal redundancy. Multimedia Authoring .

Suggested Reading:

1. Donald Hearn and M.P. Becker "Computer Graphics" Pearson Pub.
2. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill
3. Folay Vandam, Feiner, Hughes "Computer Graphics Principle & Practice" , Pearson Pub.

4. Sinha and Udai , "Computer Graphics", Tata McGraw Hill
5. Parekh "Principles of Multimedia" Tata McGraw Hill
6. Prabhat k Andleigh, Kiran Thakral , "Multimedia System Design " PHI Pub.
7. Shuman "Multimedia in Action", Cengage Learning

Computer Graphics and Multimedia (IT-502B)

CO 1. Calculate and determine various scan conversion algorithms.
CO 2. Compare various clipping and windowing techniques.
CO 3. Identify basic illumination models.
CO 4. Interpret and recognize the various multimedia formats.

B. Tech. Fifth SEMESTER INFORMATION TECHNOLOGY						
IT502 (Opln Elective I) COURSE CONTENT (AIECT w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT502C	MANAGEMENT INFORMATION SYSTEM	3	1	—		4

Module I INFORMATION SYSTEM AND ORGANIZATION

Matching the Information System Plan to the Organizational Strategic Plan – Identifying. Key Organizational Objective and Processes and Developing an Information System. Development – User role in Systems Development Process – Maintainability and Recoverability in System Design.

Module II REPRESENTATION AND ANALYSIS OF SYSTEM STRUCTURE

Models for Representing Systems: Mathematical, Graphical and Hierarchical (Organization Chart, Tree Diagram) – Information Flow – Process Flow – Methods and Heuristics – Decomposition and Aggregation – Information Architecture – Application of System Representation to Case Studies.

Module III SYSTEMS, INFORMATION AND DECISION THEORY

Information Theory – Information Content and Redundancy – Classification and Compression – Summarizing and Filtering – Inferences and Uncertainty – Identifying Information needed to Support Decision Making – Human Factors – Problem characteristics and Information System Capabilities in Decision Making.

Module IV INFORMATION SYSTEM APPLICATION

Transaction Processing Applications – Basic Accounting Application – Applications for Budgeting and Planning – Other use of Information Technology: Automation – Word Processing – Electronic Mail – Evaluation Remote Conferencing and raphics – System and Selection – Cost Benefit – Centralized versus Decentralized Allocation Mechanism.

Module V DEVELOPMENT AND MAINTENANCE OF INFORMATION SYSTEMS 9

Systems analysis and design – System development life cycle – Limitation – End User Development – Managing End Users – off– the shelf software packages – Outsourcing – Comparison of different methodologies.

TEXT BOOK:

1. Laudon K.C, Laudon J.P, Brabston M.E, "Management Information Systems - Managing the digital firm", Pearon Education, 2004.

REFERENCES:

1. Turban E.F, Potter R.E, "Introduction to Information Technology", Wiley, 2 004.

2. Jeffrey A.Hoffer, Joey F.George, Joseph S. Valachich, "Modern Systems Analysis and Design", Third Edition, Prentice Hall, 2002.

Management Information System (IT 502C)

CO 1. Identify key organizational objectives and processes for developing an Information system.

CO 2. Analyze the models for the representing systems.

CO 3. Determine and identify information needed to support decision making.

CO 4. Development and maintenance of information systems.

B.E. FIFTH SEMESTER (INFORMATION TECHNOLOGY)						
COURSE CONTENT (CBGS w.e.f. July 2017)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 503	Computer Networks	3		2		4

Module I Importance of computer networks, broadcast and point to point networks, Local area networks and Wide area networks , Introduction to ISO-OSI reference model, TCP/IP reference model , function of each layer, interfaces and services, Protocol data unit, connection oriented and connectionless services, service primitives, comparison of TCP/IP and ISO-OSI reference model, Novel Netware, Arpanet ,X.25

Module II **Data-Link layer:** - Data link layer design issues, framing , flow & error control , physical addressing, Stop & Wait protocol ,Go back N ARQ ,selective repeat ARQ, piggybacking and pipelining ,HDLC LAN Protocol stack-Logical link control and Media Access Control sub layer, IEEE 802.2 LLC Frame format Data link layer in the internet, Serial line IP and Pont to point protocol

Module III **MAC layer Protocols-** , static and dynamic allocation , Pure and slotted ALOH A protocols, Carrier sense multiple access, Persistent and non persistent CSMA, IEEE standard 802.3 and Ethernet,802.3cabling, IEEE 802.4, IEEE 802.5, FDDI Wireless LAN , Zigbee, Bluetooth, 6lowPan, Comparison of wired and wireless LAN, WIMAX

Module IV **The Network layer**- logical addressing, class full & classless addressing , address mapping ,packet delivery & forwarding. unicast routing protocols , multicast routing protocols, Routing algorithm-Least Cost, Dijkstra's, Bellman-ford, congestion control algorithms, Internetworking devices, Introduction to Internet protocol IPv4 & IPv6

Module V **Transport layer**-Transport services , Process to process delivery, UDP ,TCP ,congestion control , quality of service , Integrated services, Differentiated services LAN-WAN Design and implementation-Configuring TCP/IP, using IP configure, ping command , study of structured LAN , study of internetworking devices an d their configuration– switches, hubs, Bridges, routers and Gateways

References:-

1. "Local area networks ", Forouzan, TMH, 1st edition

2. "Computer Networks" - Tanenblaum ,PHI Learning.

3. "Computer Networks" ,N Olifer and V Olifer ,Wiley publication

4."Computer Communications & Networking Technologies"-Michael A. Gallo & William M. Hancock -Cengage pearsen publications.

5."Computer Networks: Protocols, Standards and Interfaces"- By Black, PHI learning pub.

Suggested List of Experiment:-

1. Establishment and configuration of LAN
2. Color coding standard of CAT 5,6,7 and crimping of cable in RJ-45
3. Study of WAN
4. Case study of STOP AND WAIT Protocols
5. Study of sliding window protocol
6. study of IEEE 802.3 , 802.4 ,802.5
7. Study of FDDI
8. Study of basic networking commands like ping, ipconfig, etc
9. Case study of va rious Routing Strategies
10. Case studies of various Network Topologies
11. Establishing & studying the various parameters of a home LAN Network
12. Study of IOS of routers
13. Configuring routers, bridges and switches and gateways

Computer Networks (IT 503)

CO 1. Infer the importance of computer networks and ISO-OSI reference model.
CO 2. Compare various logical link control protocols.
CO 3. Outline standard, 802.3 and Ethernet technology.
CO 4. To classify logical addressing mode and introduce internet protocol (IPV4 &IPV6).
CO 5. Illustrate TCP, UDP protocols with configuration implementation of internetworking devices.

B.Tech. FIFTH SEMESTER (INFORMATION TECHNOLOGY)						
COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 504	Operating System	3	—	2		4

Module I **Introduction to Operating System:** Evolution of Operating System Types of Operating system Batch Processing, Real Time, Multitasking & Multiprogramming, time-sharing system. Operating system services, Operating system structure, System Call & System Boots, Operating system design & Implementations, System protection, Buffering & Spooling.

Module II **Process Management:** Basic concepts of CPU scheduling, Scheduling criteria, Scheduling algorithms, algorithm evaluation, multiple processor scheduling. Process concept, operations on processes, threads, inter process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock problem, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, Methods for deadlock handling.

Module III **Memory Management:** Concepts of memory management, logical and physical address space, swapping, Fixed and Dynamic Partitions, Best-Fit, First-Fit and Worst Fit Allocation. Virtual Memory Management- paging, segmentation, and paging combined with segmentation. Cache Memory Organization, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentation.

Module IV **File Management:** File systems: What is a file, user view of files, file types and file operations, file types in Unix and Microsoft, file operation commands, file access rights, file storage management, Inode or FAT structure, file control blocks, root file system, directory and file paths, blocks, impact of block size selection, contiguous allocation, chained and indexed allocations, Impact of allocation policy on fragmentation, mapping file blocks on the disk platter, cylinder, disk access control and scheduling

Module V **Input Output management & Security:** Issues in human centric, device centric and computer centric IO management, input output modes, programmed IO, polling, interrupt mode of IO, various types of interrupts, interrupt servicing, priority interrupts, interrupt vectors, direct memory access (DMA) mode of transfer, setting up DMAs, device drivers, interrupt handling using device drivers, buffer management, device scheduling, disk scheduling algorithms and policies. Role of Operating System in Security, Security Breaches, System Protection, and Password Management.

Case study: Linux, Unix, Window XP

Text Book:

1. Tanenbaum " Modern Operating System" PHI Lea rning.

Reference Books:

1. M. Flynn " Operating Systems". Cengage Learning.
2. Silberschatz ,"Operating system", Willey Pub
3. Dhamdhere, "System Programming and Operating System",TMH.
4. Stuart,"Operating System Principles, Design & Applications", Cengage Learning
5. Operating System : Principle and Design by Pabitra Pal Choudhury, PHI Learning

Suggested List of Experiment:-

1. Program to implement FCFS CPU scheduling algorithm.
2. Program to implement SJF CPU scheduling algorithm.
3. Program to implement Priority CPU Scheduling algorithm.
4. Program to implement Round Robin CPU scheduling algorithm.
5. Program to implement classical inter process communication problem(producer consumer).
6. Program to implement classical inter process communication problem(Reader Writers).
7. Program to implement classical inter process communication problem(Dining Philosophers).
8. Program to implement FIFO page replacement algorithm.
9. Program to implement LRU page replacement algorithm
10. Program to implement LFU page replacement.
11. Program to implement Optimal page replacement.

Operating System (IT 504)

CO 1. To introduce various types of OS and its services.
CO 2. To analyze and discuss various CPU scheduling algorithms.
CO 3. To give overview of deadlock prevention , avoidance and detection techniques.
CO 4. To compare various memory management techniques.
CO 5. To understand the file system and various IO management techniques.

B.Tech. Fifth Semester (INFORMATION TECHNOLOGY)						
COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 505	DATA BASE MANAGEMENT SYSTEM	3		2		4

Module 1 Basic Concepts: DBMS Concepts and architecture Introduction, Database approach v/s Traditional tile accessing approach, Advantages of database systems, Data models, Schemas and instances, Data independence, database users and DBA.

Module II: Data models and their Comparison, Entities and attributes, Entity Sets, Relationships, Extended E-R Features Defining the E-R diagram of database Relational Data models: Domains, Tuples, Attributes, Relations, and Integrity constraints. Key (super key, candidate key, primary key, foreign key, and referential key)

Module III: Structured Query Language ,Relational Query languages: Relational algebra, Relational algebra operations like select, Project, Join, Division, outer union. SQL: DDl, DML and their commands, Aggregate function, nested subquery, views in SQL, join Data retrieval queries, accessing SQL from programming language.

Module IV: Database Design Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, multi-valued dependencies.

Module V: Transaction Processing Concepts: - Transaction System, Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling. Concurrency Control Techniques: - Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction. Introduction to Distributed databases, data mining, data warehousing.

Text Books:

1) Database System Concepts, Silberschatz, Korth and Sudarshan

2) Fundamental of database system by Elmasri / Navathe the Benjamin / Cunnings Publishing company inc.

Reference:

3) Data Base Management System by C.J. Date

4) Data Base Management System by Ullman

5) Data base design by Gio Wiederhold. McGraw Hill

6) Fundamental of Data Base Management System by Leon & Leon, Vikas Publishing House Pvt. Ltd.

7) Oracle 9i Database Administration Fundamental-I, Volume I, Oracle Press,TMH.

CO 1. Understand the various data models.

CO 2. Apply the different operations over the relations using various queries.

CO 3. Obtaining the normalized relation by using different normal forms.

CO 4. Recognize the concurrency control techniques.

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) V Semester (Artificial Intelligence & Data Science)

w.e.f. July 2021

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	BT511	HSMC	Professional Ethics	70	20	10	-	-	100	3	-	-	3
2	AI502	OEC	Elective I	70	20	10	-	-	100	3	1	-	4
4	AI503	PCC	Deep Learning	70	20	10	30	20	150	3	-	2	4
3	AI504	PCC	Data Science	70	20	10	30	20	150	3	-	2	4
2	AI505	PCC	Digital & Wireless Communication	70	20	10	30	20	150	3	-	2	4
6	AI407	DLC/PI	Industrial Training (Viva)	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	AI508	DLC	SWAYAM/NPTEL/MOOC	-	-	-	-	-	-	-	-	-	**8**
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier/-									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum three additional MOOC courses in subject code AI508 for the award of Honours Degree (Minor Specialization).									

Note: Departmental BOS will decide list of three elective subjects for each PEC/OEC (Professional /Open Elective Courses). Industrial training viva shall take place in V Sem. which students have already done in IV Sem.

Open Elective Courses I		
S.No.	**Subject Code**	**Subject Name**
1	AI502A	Probability and Random Process
2	AI502B	Theory Of Computation
3	AI502C	Information Theory & Coding

HSMC	Humanities Sciece and Managerial Courses
OEC	Open Elective Course
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning / Project Internship Courses/Project and Internship, MC: Mandatory Courses

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

28/7/2023

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(Based on AICTE Model Curriculum based scheme)
B. Tech V Sem (AI & DS)
COURSE CONTENT

(w.e.f. July 2021 Onwards)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT-511	Professional Ethics	70	20	10	-	-	100	3	-	-	3

Module l. HUMAN VALUES:

Morals, values and Ethics-Integrity-Work Ethics-Service Learning-Civics virtue-respect for others-Living peacefully - Caring – Sharing - Honestly – Courage - Valuing time- Cooperation - Commitment-Empathy - Self Confidence – Character – Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

Module ll: ENGINEERING ETHICS:

Sensors of Engineering Ethics- Variety of moral Issues- Types of Inquiry – Moral dilemmas- Moral autonomy- Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professional roles – Theories about right action – self interest – Customs and Religion- Uses of Ethical Theories.

Module III : ENGINEERING AND SOCIAL EXPERIMENTATION:

Engineering as Experimentation – Engineering as responsible Experimenters – Codes of Ethics – A balanced Outlook on Law.

Module IV: SAFETY,RESPONSIBILITIES AND RIGHT:

Safety and Risk – Assessment of Safety and Risk – Risk Benefit analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentially – Conflict of interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Module V : GLOBAL ISSUES:

Multinational Corporations – Environment Ethics – Computer Ethics – Weapons Development – Engineering as Managers – Consulting Engineers – Engineering as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate social Responsibility.

TEXT BOOKS :

1.Mike W.Martin and Roland Schinzinger, "Ethics in Engineering" Tata Mc-Graw Hill New Delhi,2003.
2.Govindaranjan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi,2004.

References:

1.Charies B. Feddermann, "Engineering Ethics" Pearson Prentics Hall, New Jersey 2004

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2.Charies E. Herris Michael S. Pritchard and Michael J. Rabins "Engineering Ethics – Concepts and cases" Learning, 2009.
3.John R Boatright, "Ethics and the conduct of Business" , Pearson Education New Delhi 2003.
4.Edumund G Seebauer and Robert L Barry, "Fundamental of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001.
5.Laura P. Hartman and joe Desjardins, "Buisness Ethics: Decision Making for Personal Intigrity and Social Responsibility" Mc Graw Hill Education India Pvt Ltd, New Delhi 2013.
6.World Community Service Centre, "Value Education",Vethathiri publication, Erode 2011.

COURSE OUTCOMES: Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society .At the end of the course the student will be able to

CO1	Understand Human Values
CO2	Apply Engineering Ethics.
CO3	Apply Engineering as Social expectation.
CO4	Assess Safety and Risks.
CO5	Deep Perception of Global Issues.

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Jabalpur (M.P.)

JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
Established in 1947 as Government Engineering College, Jabalpur
(Declared autonomous by Govt. of M.P. in 1998)
(B. Tech V Sem (AI & DS)
COURSE CONTENTS **w. e. f. July 2021**

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI502A	Probability and Random Process	70	20	10	30	20	150	3	1	-	4

Module-I: Probability Axioms of probability conditional
Probability Bay's theorem discrete and continuous random variables, Moments, Moment generating functions Binomial, Poisson Geometric, uniform, Exponential and neural distribution.

Module-II: Two-dimensional Random. Variables
Joint distributions, Marginal and conditional distributions Covariance correlation and linear regression, Transformation of random variables, central limit theorem (for independence and identically distributed random variables)

Module-III: Random Processes
Classification stationary process Markov process, Markov chain Poisson process, Random telegraph process.

Module-IV: Correlation and spectral densities
Autocorrelation functions, cross correlation functions and properties, power spectral density, cross spectral density properties.

Module-V: Linear system with Random Inputs
Linear time invariant system, sytem transfer function, linear systems with random inputs, auto correlation and cross correlation function of input and output

Books:
1. Probability and Random Processes By S. Palaniammal, Prentice Hall, 2011
2. Probability theory and Random Processes By K. Mergu CBS Publisher.

Course Outcomes: Upon successful completion of course students will be able to:

CO1	Basic understanding of probabilities and various type of distributions.
CO2	Understanding of conditional & point probability, various, stationary process, markov process.
CO3	Developing concept of spectral density and system transfer function

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JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
Established in 1947 as Government Engineering College, Jabalpur
(Declared autonomous by Govt. of M.P. in 1998)
COURSE CONTENTS **w.e.f. July 2022**

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI502B	Theory of Computation	70	20	10	30	20	150	3	1	-	4

Module-I Introduction of Automata Theory

Examples of automata machines, Finite Automata as a language acceptor and translator, Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, Equivalence of NDFA and DFA, minimization of automata machines, 2 way DFA. Moore mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.

Module-II: Regular Expressions and Languages:

Arden's theorem. Finite Automata and Regular Expressions, From DFA's to Regular Expressions, Converting DFA's to Regular Expressions. Properties of Regular Languages, The Pumping Lemma for Regular Languages, Applications of the Pumping Lemma Closure Properties of Regular Languages, Decision Properties of Regular Languages.

Module -III: Grammars:

Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, Eliminating null and unit productions. Chomsky normal form and Greibach normal form.

Module-IV: Push down Automata:

example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petrinet model.

Module-V: Turing Machine:

Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable & undecidable languages, Halting problem of Turing machine & the post correspondence problem.

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Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Pearson Education, India.

2. K. L. P Mishra, N. Chandrashekaran "Theory of Computer Science-Automata Languages and Computation", Prentice Hall of India.

3. Harry R. Lewis & Christos H. Papadimitriou,, "Element of the Theory computation ", Pearson.

4. Cohen, D.I. and Cohen, D.I., "Introduction to computer theory", Wiley.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Illustrate conceptual knowledge of switching and finite automata theory & languages.
CO2	Develop concept of abstract models of computing such as NFA, DFA, PDA. Turing machine and to check their power to recognize the languages
CO3	Interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO4	Classify types of grammars, simplification and normal form and P. NP problems.

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(Based on AICTE Model Curriculum based scheme)
B. Tech V Sem (AI & DS)
COURSE CONTENT **(w.e.f. July 2023)**

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI502C	Information Theory And Coding	70	20	10	30	20	150	3	1	-	4

Module -I

Source Coding: A logarithmic measure of information, Average mutual information and entropy, Information measures for continuous random variables, Noiseless coding theorem, Coding for discrete memoryless sources, Discrete stationary sources, The Lampel-Ziv algorithm, Coding for analog sources, rate distortion function.

Module -II

Channel Capacity and Coding: The converse to the coding theorem, Channel models, Channel capacity, Achieving channel capacity with orthogonal Signals, Channel reliability functions, Random coding based on M-ary Binary-coded signals, Practical Communication systems in light of Shannon's equation.

Module -III

The Noisy-channel coding theorem: Linear Block codes, The generator matrix and the parity check matrix, Some specific linear block codes, Cyclic codes, Decoding of linear block codes, bounds on minimum distance of the linear block codes.

Module -IV

Convolutional Codes: Basic properties of the convolutional codes, The transfer function of a convolutional code, Optimum decoding of convolutional codes- The Viterbi algorithm, Distance properties of binary convolutional codes, Other decoding algorithms for convolutional codes, Practical considerations in the application of convolutional codes.

Module –V

Complex codes based on combination of simple codes: Product codes, Concatenated codes, Turbo codes, The BCJR algorithm.

Coding for Bandwidth-constraint channels: Combined coding and modulation, Trellis coded modulation.

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References Books :

1. Simon Haykins: Communication Systems, 4th Edition, John Wiley.
2. J. G. Proakis: Digital Communications, McGraw Hills
3. B.P. Lathi: Modern Analog and Digital Communication System, Oxford University Press
4. R. G. Gallager: Information Theory and Reliable Communication, John Wiley and Sons
5. A. J. Viterbi and J. K. Omura: Principles of Digital Communications and Coding, McGraw Hill Series.
6. U. Madhow: Fundamentals of Digital Communication, Cambridge University Press.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand various source coding algorithm.
CO2	Describe channel capacity.
CO3	Translate noise channel coding theorem.
CO4	Understand various types of the convolution codes.
CO5	Execute complex codes based on combination of simple codes.

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JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
Established in 1947 as Government Engineering College, Jabalpur
(Declared autonomous by Govt. of M.P. in 1998)
B. Tech V Sem (AI & DS)

COURSE CONTENTS **w. e. f. July 2021**

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI503	Deep Learning	70	20	10	30	20	150	3	-	2	4

Module- I
Basics of neural networks, perception algorithm feed forward and Back propagation Networks, idea of computational units. Mc Culloch Pitts unit and threshold logic unit, Linear perception, perception learning algorithm.

Module-II
Feed Forward network, multilayer Perception, Gradient descent, Back propagations Empirical risk minimization, regularization auto encoders.

Module-III
Convolutional networks, convolution separation, verity of basic convolution function, structured outputs, Data types, Le Net, AlexNet.

Module-IV
Recurrent Neural Networks Bidirectional RNNS deep recurrent N/W, Recursive Neural Network the long short time memory & other gated Recurrent Unit.

Module-V
Deep Generative models, Boltzmann Machines, Restricted Boltzmann machines, machines introduction to MCMC and cubbs seeping gradient N/W Deep Boltzmann machines. Deep Boltzmann machines, application of deep learning in speech recognition

Books:
(1) Deep learning MIT, Press 2016 By Ia Good fellow, Yoshna Brangio
(2) Fundamental of deep learning By Nikhil Budeima, O'Reilly Publication
(3) Make your own neural network By Tariq Pashid

Course outcomes: After completion of course, student will be able to:

CO1 Understand basic concept of deep learning.
CO2 Knowledge of deep learning algorithm.
CO3 Understanding CNN RNN in real world application.
CO4 Applying Deep Learning in practical application.

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List of Experiments (AI504 L)

1. Implementation of different activation functions to train Neural Network. using Matlab
2. Implementation of different learning Rules.
3. Implementation of Perception Networks
4. Implementation of adaline network for system Identification
5. Implementation of the Madaline networks
6. Pattern matching with different rules.
7. Project related to application of machine learning in health care
8. Project related to application of machine learning in business analytics.
9. Pin point implementation of application of deep learning in sports analytics.
10. Deep learning project in Time series analysis and fore casting.
11. Generate generic Python code for deep learning Networks ..
12. Create and Explore Data store for image classification using deep learning .

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COURSE CONTENT **(w. e. f. July 2023)**

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI504	DATA SCIENCE	70	20	10	30	20	150	3	-	2	4

Module I: Introduction:

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Module II: Data Collection and Data Pre-Processing:
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Module III: Exploratory Data Analytics:
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Module IV: Model Development:
Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Module V: Model Evaluation:
Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Suggested Books:

Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
4. https://padhai.onefourthlabs.in/courses/data-science

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COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO 1	Demonstrate proficiency with statistical analysis of data.
CO 2	Build and assess data-based models.
CO 3	Execute statistical analyses with professional statistical software.
CO 4	Demonstrate skill in data management.
CO 5	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

List of Experiments:- AI503L

1. Write R – Programming to plot various charts and graphs. You have to consider minimum two popular data sets and draw all the statistical observations.
2. Write a python Program to apply EDA on any two popular data sets and provided your analysis and interpretations. Use matplotlib library of python along with other libraries for the analysis and interpretation.
3. Write Python program to implement K-Means using inbuilt python Library. Also, write your own program to implement K-Means without using the inbuilt function. Compare and contrast the results.
4. Write a python program to implement a Spam Filter using Linear Regression and K-NN. Use a popular dataset.
5. Write a Python Program to Scrapping the Web using suitable API. Create a usable dataset for classification and clustering purpose.
6. Write a Python Program to implement Filter and Wrappers.
7. Write a Python Program to implement Decision Trees, Random Forests – The inbuilt functions should not be used for the implementation.
8. Write a python Program to implement Singular Value Decomposition and Principal Component Analysis. Use any popular data set.
9. Write a python Program to extract the friendship details of your face book account as Social network Graph and represent in various visual forms.
10. Write Python Program using Bokeh 2.1.1 realize the all the basic principles of data visualization.
11. Consider any popular dataset and present complex visualization principle using Bokeh 2.1.1.

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B. Tech V Sem (AI & DS)
COURSE CONTENT (w. e. f. July 2023)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI505	Digital And Wireless Communication	70	20	10	30	20	150	3	-	2	4

Module-I: Analog & Digital Communication

Analog Modulation, Sampling Theorem, Digital Modulation, AM Modulation, FM Modulation, Phase Modulation, Demodulation techniques, PCM Basic, ADM, DM, DPCM, PPM, PAM quantization in PCM

Module-II: Communication System

Overview of communication and information theory, coding- Shannon fano and halffman, LZW coding, Communication protocols in brief, Decoders – Viterbi Decoder, Redundancy coder – decoder and advanced decoders in trends.

Module-III: Mobile Communication

Mobile communication, block diagram, protocols and channel. Introduction to mobile communication Block Diagram, Transmitter, Base Stations, Routers communication, protocols, channels, and multi path channels, path loss, Fading, etc.

Module-IV: Wireless Communication

Wireless communication, Advanced Modulator and Demodulators, Overview of TDMA, FDMA, CDMA, WCDMA and OFDMA. Different Generations of 3G/4G/5G/6G of wireless communication system and advancement in technology in mobile, radio and wireless Communication.

Module-V: Communication System & Standards

Advance Wireless System and Communication Standards Like MPEG – 4, MPEG -7, JPEG- 2000, All Audio, Speech coders, MP3, H.264, G.711, G.722, etc.

Reference Books:

1. Fundamentals of Wireless Communication: David Tse and PramodViswanath
2. Principles of Mobile Communication : Gordon L. Stüber
3. WIRELESSCOMMUNICATIONS : AndreaGoldsmith
4. Wireless Communication Principles and Practice : T. S. Rappaport

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Course outcomes:

After completion of course, student will be able to:

CO1	Understand basics concept of Digital modulation techniques
CO2	Comprehend statistical multipath channel modes and path loss.
CO3	Knowledge of capacity of various wireless channels.
CO4	Analyze the diversity in wireless channels.
CO5	Elaborate various wireless systems and standards, 4G, 5G

List of Experiment:-AI502L

1. Verification of sampling theorem.

2. Generation and detection of PCM signals

3 Determine the response of of delta modulation

4. Analysis of responses of ASK

5 Analysis of responses of PSK

6. Experiment on time division multiplexing and other access techniques.

8. Study of 4G and 5G communication System

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Jabalpur Engineering College, Jabalpur

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(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Mechanical Engg.)

w.e.f. July 2017-18 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	ME501	HSMC	Entrepreneurship and Management Concepts	70	20	10	-	-	100	3	-	-	3
2	ME502	OEC	Open Elective - I	70	20	10	-	-	100	3	1	-	4
3	ME503	PCC	I.C. Engines	70	20	10	30	20	150	3	-	2	4
4	ME504	PCC	Turbo Machines	70	20	10	30	20	150	3	-	2	4
5	ME505	PCC	Dynamics of Machines	70	20	10	30	20	150	3	-	2	4
6	ME407	DLC/PI	Industrial Training/Internship Evaluation	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	ME508	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	4
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional courses in subject code ME508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	ME502A	Instrumentation Measurement & Control
2	ME502B	Mechatronics
3	ME502C	TQM and SQC

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

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B. Tech. (AICTE) V Sem. (Mechanical Engineering)

(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
ME501	Entrepreneurship and Management Concepts	70	20	10	-	-	100	3	-	-	3

Course Objective:

To familiarize the students with the concepts and applications of Management, Marketing, Productivity & Entrepreneurship in competitive world.

COURSE CONTENTS:

Module -I: **System Concepts:** Types, definition & characteristics; supra & subsystems, key component; boundary & interface complexity; feedback (pull) & feed forward (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alter's nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

Module -II: **Management:** Importance, definition and functions; schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making, structured and unstructured decision; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, span and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task force, business process reengineering and process of change management, HR planning placement and training, MIS; attitudes and personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

Module -III: **Marketing:** Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.

Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

Module-IV: **Productivity and Operations:** Productivity, standard of living and happiness, types of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, product and process specifications, TQM, cost of quality, introduction to lean manufacturing (JIT), QFD, TPM & six sigma quality.

Module V: **Entrepreneurship :** Definition and concepts, characteristics, comparison with manager, classification, theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors,

sources of funds, entrepreneur development program. sustainability of entrepreneurship, sustainable product, sustainability & operations management.

Evaluation:
Evaluation will be continuous and integral part of the class followed by the final examination.

References:

1. Daft R; The new era of management; Cengage.
2. Bhat Anil, Arya kumar; Management: Principles,Processes and Practices; Oxford higheredu.
3. Davis & Olson; Management Information System; TMH.
4. Steven Alter; Information systems, Pearson, www.stevenalter.com
5. Kotler P; Marketing management; 6- Khan, Jain; Financial Management; 7- ILO; Work study;ILO.
6. Mohanty SK; Fundamental of Entrepreneurship; PHI.

Course Outcomes:
At the completion of this course, students should be able to

CO1	Illustrate the concepts of work system model.
CO2	Analyze the concepts & theories of management applied to the Entrepreneurship.
CO3	Estimate capital budget and market research for a given product/service.
CO4	Evaluate Productivity, rating and various allowances; standard time in work.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	-	-	-	-	-	-	-	-	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-
CO3	2	2	-	1	-	-	-	-	-	-	-	-
CO4	2	-	1	1	-	-	-	-	-	-	-	-

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech Mechanical Engineering (V-Semester) AICTE

Credits: 4 OEC ME-502A Instrumentation Measurement & Control L: 3, T: 1, P: 0

Course Objective:

1. *Develop ability to understand basic concept of measurement system.*
2. *Develop ability to understand the mathematical modeling of measurement system.*
3. *Develop ability to analyzethe errors in measurement system.*
4. *Develop an ability to utilize control system.*
5. *Appropriate selection of instruments*

COURSE CONTENTS:

Unit-I: Concepts of Measurement: Generalized measuring system, Classification of measuring instruments, Standards of measurements. Measurement errors:Types of error.Calibration of measuring instruments: Static calibration, dynamic calibration.Input-output configuration of measuring instrument and measurement system.

Unit-II: Measuring Instrument Characteristics:
Statics analysis data: Normal distribution curve and standard deviation. Least square regression analysis. Uncertain analysis. **static characteristics**, : accuracy and precision, range and span, repeatability and reproducibility, drift sensitivity ete. **Dynamic characteristics**: dynamic response: zero order, first order and second order system response.

Unit-III: Temperature , Pressure and Flow Measurement
Temperature Measurement:-international practical temperature scale, types of temperature measuring instruments : Liquid in glass thermometers, Bimetallic Thermometers; pressure thermometers, Electrical resistance thermometry; Resistance Temperature Detectors. Thermocouples & thermocouple standards. Pressure Measurement: mechanical pressure gauges : low pressure and high pressure gauges: Mcleod gauge, ionization gauges. Electrical pressure transducers: piezoelectric, photoelectric pressure transducer etc.

Unit-IV: Strain, force, Torque and Velocity Measurement:-
Mechanical strain gauge, Resistance strain gauges, Displacement measurement: Linear and variable differential transformers, angular displacement. Velocity measurement: linear and angular velocity. Force measurement: scale and balances. load cells: piezoelectric load cells etc. Torque measurement Methods.

Unit-V: Introduction to control systems: Open loop and closed loop control systems, block diagram of closed loop control system. Mathematical modeling of mechanical systems : fluid flow, hydraulic and thermal systems. Transfer function, steady state response analyses: First order systems, unit step and unit impulse response of first order systems, second order systems. Hydraulic control.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Nakra and Chaudhry; instrumentation, Measurement and analysis; TMH
2. Figiola RS & Beasley DE; Theory and Design for Mechanical Measurements; 3e John Wiley
3. Katsuhiko Ogata; Modern Control Engineering, 4e Pearson Education, New Delhi
4. Gopal; Control Systems Principles and Design; Tata McGraw Hill, New Delhi.
5. Backwith and Buck; Mechanical Measurements.
6. Swhney; Metrology and Instrumentation.
7. A. K.Sawhney; Mechanical measurement and control, Dhanpat Rai Publications.
8. D.S. KUMAR; Mechanical measurement and control, Metropolitan Book Co. Pvt. Ltd.

On the completion of the course student will be able to-

CO1	Define the basic concepts of measurement systems & Intrumentation.
CO2	Discuss principles of mathematical modeling for measuring & control systems.
CO3	Analysis the errors and uncertainty in measurement system

Mappings

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	2	-	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-

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(w.e.f. July 2019)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
ME502B	OEC-I (Mechatronics)	70	20	10	-	-	100	3	1	-	4

Course Objective:

1. *To revise basic electronic/electrical concepts and understand the use of basic electronics components like sensors,diodes,actuators, transistors etc and their use in amplification and switching*
2. *To enable students to use microprocessor ,microcontroller and PLC to automate Mechanical Systems*
3. *To make students use of MEMs and Nanotechnology by various fabrication techniques.*

COURSE CONTENTS:

Module-1. **Introduction to Mechatronics** **6 Hrs**

Definition and scope, various philosophies for forming Mechatronics, application role of electrical- mechanical- electronics, hydraulic and pneumatic systems in Mechatronics, various applications in day to day life.

Module- **2. Sensors, actuators, Control Devices** **7 Hrs**

Hydraulic and pneumatic actuators, Electrical actuation system, AC-DC motors with their characteristics and application, Introduction and application of stepper motors.

Control Devices

Classification of control devices, Different types of switches with working, Construction of Relays and contactors, Use of Relays and contactors.

Module- **3. Microprocessor and Microcontroller** **7 Hrs**

Definition, Architecture and addressing mode of microprocessors, Instruction set and programming for 8085 with assembly language, Application of microprocessor

Introduction to Micro Controller

Applications and programming for micro controllers, Interfacing of microcontroller to sensors and actuators.

Module- **4. Programmable Logical Controller(PLC)** **7 Hrs**

PLC Basic structure, Input output processing timers relays counter, Analog and Digital inputs, Introduction to PLC programming, Ladder logic programming, Interfacing of sensors to PLC.

Module- **5. Signal and Data Processing** **6 Hrs**

Principals of analog signal conditioning, Signal level, Charges unlinearization, Conversion, Filtering, Digital signal conditioning, DAC/ADC, Data acquisition system, Data presentation system

Module- **6. MEMs and Nanotechnology** **6 Hrs**

Concept, Background, Micro-sensors, Micro-machining, Micro-actuators, Modeling and simulation, Concept of Nanotechnology, Carbon nano-tubes, Various fabrication techniques of MEMs, Performance parameters, Hazards and safety measures regarding Nano components.

Course Outcomes:

On the completion of the course student will be able to-

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Connect basic electrical/electronic components like diodes, transistors, sensors to form meaningful circuits and analyze them.	2	Understanding
CO2	Apply logic for operating a particular system by using a microprocessor, microcontroller or a PLC.	3	Applying
CO3	Select and calibrate sensor and use it for sensing Mechanical/Electrical parameters.	4	Analyzing
CO4	Develop a system by using MEMs and Nano technology fabrication techniques.	6	Creating

Mapping of Course outcomes (COs) with Program Outcomes (POs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	2	-	-	-	-	2	-	2	-
CO2	-	-	2	-	-	-	-	-	2	-	2	-
CO3	-	-	-	2	2	-	-	-	3	-	3	-
CO4	-	-	2	-	-	-	-	-	2	-	2	-

Jabalpur Engineering College, Jabalpur
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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
ME502C	OEC-I (TQM and SQC)	70	20	10	-	-	100	3	1	-	4

Course Objective:

1. *To understand the importance of quality for mechanical engineer.*
2. *To apply various tools and techniques of SQC to improve productivity.*
3. *To learn process diagnostics and process improvement techniques.*

COURSE CONTENTS:

MODULE1 **Evolution** of total quality management(TQM), historical perspective, teamwork, TQM and ISO9000; information technology and Business Process Re-engineering (BPR); Total productive maintenance (TPM) and quality awards; aids and barriers to quality management, creating vision and initiating transformation, establishing programs for education and self-coordination, policy setting and review, flowchart of policy management and relation with daily management. improvements, measurement of key indicators; quality management leader; cross functional teams and coordination, policy setting and review, flowchart of policy management and relation with daily management.

MODULE2 **Process-** definition, variation and feedback, funnel-marble experiment- rules of adjustment and its effects, quality- definition, goalpost and kaizen view, quality of design, conformance and performance; Taguchi loss function, cost of quality, chain action of improving quality to productivity to motivation and low cost; Deming's theory of management, fourteen points and variance reduction; attributes enumerative and variables analytic studies.

MODULE3 **SQC-Control charts:** basic discrete and continuous distributions, measures of central tendency, variability and shapes, sampling, size and central value theorem, control chart structure, process plotting and stability, study of out-of-control evidences, defect detection and prevention, use of control charts in evaluating past, present and future trends; attribute control charts, count and classification charts, construction and interpretation of p , np , c, u and X charts, PDSA cycle(plan, do, study, act), and R charts, and s charts, individual and moving range chart, trial control limits and out of control points.

MODULE4 **Process diagnostics:** Between and Within Group variations, periodic and persistent disturbances, control chart patterns-natural, level-shift, cycle, wild, multi-universe, relationship and other out of control patterns; diagnosing a process, brainstorming; cause-effect, Ishikava, interrelationship, systematic and matrix diagrams; change concepts and waste elimination

MODULE5 **Process improvement:** Performance and technical specifications, attribute-process and variable-process capability studies; unstable and stable process capability studies and examples; attribute and variable improvement studies; Inspection: acceptance sampling(AS)- lot formation, single, double and multiple/sequential sampling plans, operating characteristic (OC) curve, producer and consumer risk, theoretical invalidation of AS, kp rule for stable and chaotic processes.

References:

1. Gitlow HS, Oppenheim et al; Quality Management; TMH.
2. Gryna FM; Juran's Quality Planning and Analysis; TMH.
3. Crosby Philips; Quality is still free; New Amer Library.
4. Kulkarni VA and Bewoor AK; Quality Control; Wiley.
5. Jankiraman B and Gopal RK; Total Quality Management- Text and Cases; PHI Learning.
6. Sugandhi L and Samual A; Total Quality Management; PHI Learning.
7. Subburaj R; Total Qality Management; TMH.
8. Naidu Babu and Rajendran; TQM; New age International pub.
9. Chase Richard B et al; Operations management; SIE-TMH.
10. Chary SN; Production and Operations Management; TMH.

Evaluation

Evaluation will be continuous and integral part of the class as well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Understand the evolution and basics of Total Quality Management & its processes.
CO2	Apply various control chart techniques.
CO3	Analyze Process diagnostics and process improvement techniques.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	-	-	-	-	-	-	-	-	1
CO2	2	1	2	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	1	-	-	-	-	-	-

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech. Mechanical Engineering (V-Semester) AICTE

Credits: 4	PCC	ME-503 : Internal Combustion Engines	L: 3, T: 0, P: 2

Course Objective:

1. *To make students familiar with performance characteristics of I.C. engines.*
2. *To study the thermodynamics, combustion, heat transfer, friction and other factors affecting I.C. engines performance.*
3. *To study conventional and modern system being used in I.C. engines.*
4. *To study future fuels of engines.*
5. *To study different types of superchargers and supercharging methods.*

COURSE CONTENTS:

MODULE I: Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines, valve timing.

MODULE II: Combustion in SI engines: Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects of detonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels, octane number, H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features of various types of combustion chambers, valve timing and firing order.

MODULE III: Combustion in C.I. Engines: Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, octane number, knock inhibitors, salient features of various types of combustion chambers, fuel, ignition, cooling, exhaust and lubrication systems; Simple problems on fuel injection, various types of engines, their classification and salient features. Rotary I. C. engines, their principles of working.

MODULE IV: I.C. Engine System: Fuels, ignition systems, cooling, exhaust/scavenging and lubrication system. Fuel metering in SI engine: Fuel injection in SI engine (MPFI & TBI), Theory of carburetion, simple problems on carburetion. Fuel metering in CI engines: Fuel injection in CI engine and simple problems, various types of engines, their classification and salient features. Fuels: Conventional fuels and alternate fuels, engine exhaust emission, carbon monoxide, unburnt hydro carbon, oxides of nitrogen, smoke, density, measurement and control, hydrogen as alternate fuel.

MODULE V: Supercharging. Effect of attitude on mixture strength and output of S.I. engines, low and high pressure super charging, exhaust, gas turbo-charging, supercharging of two stroke engines.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Ganeshan V; Internal Combusion engines; TMH
2. Mathur ML & Sharma RP; A. Course in IC engines; DhanpatRai
3. Gupta HN; Fundamentals of IC Engines; PHI
4. Srinivasan S; Automotive Engines; TMH
5. Halderman JD and Mitchell CD; Automotive Engines theory and servicing; Pearson
6. DomKundwar; Internal Combustion Engines ; Dhanpat Rai Publications
7. Taylor GF; Internal Combustion Engines Theory & Practice; MIT Press
8. Richard Stone; Introduction to IC Engines; Society of Automotive Engr (Palgrave McMillan)

Course Outcomes:

At the completion of this course, students should be able to

CO1	Discussthe working of I.C. enginesand various engine systems.
CO2	Analyze the performance of SI and CI engines.
CO3	Identify I.C. engines for different engineering applications.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	1	-	2	-	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-

Course Outcomes Lab:

Internal Combustion Engines ME503

List of Experiments:

1. Determination of Valve timing diagram for S.I. and C.I. four stroke engines.
2. To study the performance parameters of I.C. engines and draw Heat Balance sheet.
3. Study of Battery Ignition system and magneto Ignition System.
4. Study of lubricating system in CI Engines.
5. Study of Fuel Injection system in SI Engine.
6. Study of Fuel Injection system in CI Engine.
7. Study of Carburetors.
8. Study of Diesel fuel pump and fuel injectors.
9. To find the indicated power (IP) on multi-cylinder petrol engine by Morse test.
10. Study of kirloskar diesel engine.

At the completion of this course, students should be able to

CO1	Evaluate performance parameters of SI and CI engines.
CO2	Explain various engine systems and their working.
CO3	Inspect and test engines for their performance.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	1	-	2	-	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech Mechanical Engineering (V-Semester) AICTE

Credits: 4	PCC	ME-504	Turbo Machines	L: 3, T: 0, P: 2

Course Objective:

During the course the student will be able to learn about:

1. *Steam turbines and its application in thermal power plants*
2. *Gas turbines and its application in Gas Turbine power plants*
3. *Hydraulic Turbines and its application in Hydel power plants*
4. *Pumps, compressors, blowers and fans and other equipments in power plants*
5. *Power Transmitting Turbomachines and hydraulic systems*

COURSE CONTENTS:

MODULE I: **Steam Turbines**: Classifications of steam turbines, principles of impulse and reaction machines.

Impulse Turbine: Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum utilization factor,Curtis and Rateau stage, velocity diagram, blade velocity coefficient, force, work done, blade efficiency, nozzle efficiency, gross stage efficiency, analysis for optimum efficiency, mass flow and blade height.

Reaction Turbine: Reactions staging, velocity diagram, Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines.

Governing and performance characteristics of steam turbines.

MODULE II: **Water Turbines**: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done,Hydraulic, volumetric, mechanical and overall efficiencies, draft tubes, governing of water turbines.

Performance and Characteristics: Application of dimensional analysis and similarity to water turbines, unit and specific quantities, selection of machines, Main and operating characteristics of the machines and cavitation.

MODULE III: **Rotary Fans, Blowers and Compressors**: Classification based on pressure rise, centrifugal and axial flow machines.

Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics.

Centrifugal Compressor – Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser.

Axial flow Compressors- Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis for plotting compressor characteristics, surging and choking, Polytropic and isentropic efficiencies.

MODULE IV:

Centrifugal Pumps: Classification, advantage over reciprocating type, definition of manometric head, gross head, static head, velocity diagram and work done, slip factor, efficiency and sources

of inefficiency, minimum starting speed of pump, net positive suction head, priming and cavitation, unit and specific quantities, performance characteristics.

Power Transmitting Turbomachines: Fluid coupling and Torque converter,their torque ratio, speed ratio, slip and efficiency, velocity diagrams and characteristics.

Hydrostatic Systems:hydraulic intensifier, accumulator, press and crane.

MODULE-V: **Gas Turbines:** Simple cycle, modification in simple cycle, simple cycle with heat exchanger, with reheat, with intercooler, closed cycle gas turbine, practical gas turbine cycle, optimum pressure ratio for maximum specific work output and thermal efficiency in actual gas turbine cycle, effect of operating variables on thermal efficiency.

Jet Propulsion: types, pulse jet, Ram jet, turbo jet, efficiency and horsepower of propulsion, flying unit.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Venkanna BK; turbomachinery; PHI
2. Shepherd DG; Turbo machinery
3. Csanady; Turbo machines.
4. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Wiley EasternDelhi
5. Bansal R. K; Fluid Mechanics & Fluid Machines;
6. Rogers Cohen & Sarvan Multo Gas Turbine Theory
7. Kearton W. J; Steam Turbine: Theory & Practice.
8. J. K. Jain; Gas turbine theory and jet propulsion.

Course Outcomes:

On the completion of this course, students should be able to-

CO1	Illustrate the working of different types of turbo machines.
CO2	Classify the engineering applications of different turbo machines.
CO3	Estimate the performance parameters of turbo machines.
CO4	Design the Turbomachines for specified parameters.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-
CO3	1	-	2	2	-	-	-	-	-	-	-	-
CO4	2	2	-1	-	-	-	-	-	-	-	-	-

List of Experiments:

1. Performance analysis and plotting main characteristic curves of pelton turbine.
2. Performance analysis and plotting operating characteristic curves of pelton turbine.
3. Performance analysis and plotting main characteristic curves of reaction turbine.
4. Performance analysis and plotting operating characteristic curves of reaction turbine.
5. Performance analysis and plotting main characteristics curves of centrifugal pump.
6. Performance analysis and plotting operating characteristic curves of centrifugal pump.
7. Performance analysis of centrifugal blower.

Lab Course Outcomes:

At the completion of this course, students should be able to-

CO1	Determine the performance and their operating characteristics of different types of turbines.
CO2	Elaborate the characteristic curves and its applications of different types of turbines.
CO3	Estimate the working parameters of pumps
CO4	Develop the concept of characteristic curves and use of Power Transmitting Turbo Machines

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-								
CO2	1	2	-	-								
CO3	2	3	-	1								
CO4	1	2	3	2								

List of Experiments:

1. Performance analysis and plotting main characteristic curves of pelton turbine.
2. Performance analysis and plotting operating characteristic curves of pelton turbine.
3. Performance analysis and plotting main characteristic curves of reaction turbine.
4. Performance analysis and plotting operating characteristic curves of reaction turbine.
5. Performance analysis and plotting main characteristics curves of centrifugal pump.
6. Performance analysis and plotting operating characteristic curves of centrifugal pump.
7. Performance analysis of centrifugal blower.

Lab Course Outcomes:

At the completion of this course, students should be able to-

CO1	Determine the performance and their operating characteristics of different types of turbines.
CO2	Elaborate the characteristic curves and its applications of different types of turbines.
CO3	Estimate the working parameters of pumps
CO4	Develop the concept of characteristic curves and use of Power Transmitting Turbo Machines

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-								
CO2	1	2	-	-								
CO3	2	3	-	1								
CO4	1	2	3	2								

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.Tech Mechanical Engineering (V-Semester)AICTE

Credits: 4	PCC ME-505	Dynamics of Machines	L: 3, T: 0, P: 2

Course Objective:

At the completion of the course the students will be able:

1. *To determine the velocity and acceleration of piston in a reciprocating engine mechanism and calculation of flywheel rim dimensions.*
2. *To illustrate the working of speed control mechanisms.*
3. *To demonstrate the concepts of balancing of rotors of heavy machines.*
4. *To distinguish the principles of clutches, brakes and dynamometers and calculate the brake power.*

COURSE CONTENTS:

MODULE 1: **Dynamics of Engine Mechanism**: Displacement, velocity and acceleration of piston; turning moment on crankshaft, turning moment diagram; fluctuation of crankshaft speed, analysis of flywheel.

MODULE 2: **Governor Mechanisms**: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors, hunting of centrifugal governors, effort and power of governor.

MODULE 3: **Balancing of Inertia Forces and Moments in Machines**: Balancing of rotating masses, two plane balancing, determination of balancing masses (graphical and analytical methods), balancing of rotors

MODULE 4: **Friction**: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria. **Clutches**: Single plate and multi plate clutches, Cone clutches.

MODULE 5: **Brakes**: Band brake, block brakes, Internal expanding shoe brakes.
Dynamometer: Different types and their applications.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Ambekar, AG; Mechanism and Machine Theory; PHI
2. Rattan SS; Theory of machines; TMH
3. Sharma and Purohit; Design of Machine elements; PHI
4. Bevan; Theory of Machines;
5. Ghosh and Mallik; Theory of Mechanisms and Machines; Affiliated East-West Press, Delhi
6. Norton RL; kinematics and dynamics of machinery; TMH
7. Grover; Mechanical Vibrations
8. Balaney; Theory of Machines
9. Theory of Vibrations by Thomson
10. Theory of machines through solved problems by J.S.RAO.

List of Experiments:

1. Study of various models of governors.
2. To study working of different types of brakes using models.
3. To study working of friction clutches using models.
4. To study working of different types of dynamometer.
5. To study static and dynamic balancing machines.

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Illustrate the working of flywheel, governor, clutch, brake and dynamometer.
CO2	Examine the turning moment diagrams, characteristic curve of governors, unbalanced forces and couple, failure of clutches and brakes.
CO3	Assess the motion of piston, hunting, effort and power of governor, balancing masses, frictional torque.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	1	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-	-

Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester Mechatronics Engineering

w.e.f. 2021 batch

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assign ment	End Sem.	Lab Work					
1	BT511	HSMC	Professional Ethics	70	20	10	-	-	100	3	-	-	3
2	MT502	OEC	Elective I	70	20	10	-	-	100	3	1	-	4
3	MT503	PCC	Thermodynamics & Applications	70	20	10	30	20	150	3	-	2	4
4	MT504	PCC	Smart & Embedded Instrumentation	70	20	10	30	20	150	3	-	2	4
5	MT505	PCC	Machine Design	70	20	10	30	20	150	3	-	2	4
6	MT407	DLC/PI	Industrial Training	-	-	-	60	40	100	-	-	2	1
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
7	MT508	DLC	SWAYAM/NPTEL/MOOCs	-	-	-	-	-	-	-	-	-	8
NSS/NCC/Swachhata Abhiyan/Rural Outreach				Qualifier / -									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum three additional courses in subject code MT508 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three optional subjects those are available in MOOC as well for OEC.

List of Open Elective Course - I		
S.No.	**Subject Code**	**Subject Name**
1	MT502 A	Discrete Signal Processing
2	MT502 B	Finite Element Analysis
3	MT502 C	Industry 4.0 & IIOT

HSMC	Humanities Science and Managerial Course
OEC	Open Elective Course (Interdisciplinary)
PCC	Professional/Programme Core Course
DLC/PI	Digital Learning Courses/Project and Internship

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

MOOC/DLC Courses	MOOC subjects shall be taken with permission of HOD/Coordinator

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B. Tech. Vsem (AICTE) Mechatronics Engineering /(E&TC/CSE)

(w.e.f. July 2021 Onwards)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
BT-511	Professional Ethics	70	20	10	-	-	100	3	-	-	3

Module l. HUMAN VALUES:

Morals, values and Ethics-Integrity-Work Ethics-Service Learning-Civics virtue-respect for others-Living peacefully - Caring – Sharing - Honestly – Courage - Valuing time- Cooperation - Commitment-Empathy - Self Confidence – Character – Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

Module ll: ENGINEERING ETHICS:

Sensors of Engineering Ethics- Variety of moral Issues- Types of Inquiry – Moral dilemmas- Moral autonomy- Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professional roles – Theories about right action – self interest – Customs and Religion- Uses of Ethical Theories.

Module III : ENGINEERING AND SOCIAL EXPERIMENTATION:

Engineering as Experimentation – Engineering as responsible Experimenters – Codes of Ethics – A balanced Outlook on Law.

Module IV: SAFETY,RESPONSIBILITIES AND RIGHT:

Safety and Risk – Assessment of Safety and Risk – Risk Benefit analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentially – Conflict of interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Module V : GLOBAL ISSUES:

Multinational Corporations – Environment Ethics – Computer Ethics – Weapons Development – Engineering as Managers – Consulting Engineers – Engineering as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate social Responsibility.

TEXT BOOKS :

1.Mike W.Martin and Roland Schinzinger, "Ethics in Engineering" Tata Mc-Graw Hill New Delhi,2003.
2.Govindaranjan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi,2004.

References:

1.Charies B. Feddermann, "Engineering Ethics" Pearson Prentics Hall, New Jersey 2004

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2.Charles E. Herris Michael S. Pritchard and Michael J. Rabins "Engineering Ethics – Concepts and cases" Learning, 2009.
3.John R Boatright, "Ethics and the conduct of Business" , Pearson Education New Delhi 2003.
4.Edumund G Seebauer and Robert L Barry, "Fundamental of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001.
5.Laura P. Hartman and joe Desjardins, "Buisness Ethics: Decision Making for Personal Intigrity and Social Responsibility" Mc Graw Hill Education India Pvt Ltd, New Delhi 2013.
6.World Community Service Centre, "Value Education",Vethathiri publication, Erode 2011.

COURSE OUTCOMES: Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society . At the end of the course the student will be able to

CO1	Understand Human Values
CO2	Apply Engineering Ethics.
CO3	Apply Engineering as Social expectation.
CO4	Assess Safety and Risks.
CO5	Deep Perception of Global Issues.

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Jabalpur Engineering College, Jabalpur (M.P.)
B. Tech. V Sem (AICTE) Mechatronics Engineering
Course Content

(w.e.f. July 2021 Onwards)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
MT502 A	Discrete Signal Processing	70	20	10	-	-	100	3	1	-	4

Module-I. Discrete-Time Signals and Systems: Discrete-Time Sequences, shifting and manipulation of sequences and Systems, Static, Causal, Time invariance, Linear and Stable systems. Linear constant coefficient difference equations, Derivation of transfer function of LTI systems, Frequency Domain Representation of discrete time signals & systems.

Module-II. The z-Transform Applications: The review of Direct z-transform and Inverse- Z transform sequences and Systems, Mapping of S-domain to Z- domain, System stability in Z-domain. Rational z-transform.

Module-III. Discrete Time Fourier Transform: Comparison of the DFS and Discrete Time Fourier Transform (DFT), Properties of DFT, Circular Convolution, Two dimensional DFT- FFT algorithms, Radix-2 FFT Algorithm, Goertzel's Algorithm, Decimation in time, Decimation in frequency algorithm. Concept of Decomposition for 'N' composite number in brief.

Module-IV. Basic filter structures -Recursive and non -recursive networks, System connectivity, Basic structures of IIR and FIR filters, Determining of system response, Impulse response and transfer function of filters, Determining impulse response using Recursion formula, of digital filters.

Module-V. Digital filters Design Techniques: Introduction to Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques- rectangular and other windows, Application of MATLAB for design of digital filters.

Books:

1. A.V. Oppenheim and R. W. Schafer: Digital Signal Processing, Prentice Hall.
2. L.R. Rabiner and B. Gold: Theory and Application of Digital Signal Processing, Prentice Hall
3. John. G. Proakis and Monolakis: Digital Signal Processing, Pearson Education
4. Salivahanan and Vallavraj: Digital Signal Processing, Mc Graw Hill.
5. S. K. Mitra: Digital Signal Processing- A Computer based Approach, Mc Graw Hill.
6. Schilling and Harris: Fundamentals of DSP using MATLAB, Cengage Learning.

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COURSE OUTCOMES: At the end of the course the student will be able to:

CO1	Learn to generate discrete sequences and understand the signal and system in various domain.
CO2	Analyse systems in Z Transform and stability analysis.
CO3	Analyze signal and system in frequency domain usinf DTFT and FFT
CO4	Classify various Filter structures and Synthesis of digital filters
CO5	Designing of various Digital Filters or systems

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B. Tech. V Sem (AICTE) Mechatronics Engineering
(w.e.f. July 2021 Onwards)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
MT-502 (B)	Finite Element Analysis	70	20	10	-	-	100	3	1	-	4

Module-I. Introduction: Structural analysis, objectives, static, Dynamic and kinematics analyses, Skeletal and continuum Structures, Modeling of infinite Degree of freedom(D.O.F) system into finite D.O.F. system, Basic steps in finite element problem formulation, General applicability of the method.

Module-II. Element Types and Characteristics: Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, generalized co-ordinates and nodal shape functions. 1D bar and beam elements, 2D rectangular and triangular elements, Axisymmetire elements.

Module-III. Assembly of Elements and Matrices : Concept of element assembly, Global and local Co-ordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Choleksy decomposition methods, Numerical integration, ID and 2D applications.

Module-IV. Higher Order and Iso-parametric Elements: One dimensional quadratic and cubic elements, Use of natural Co-ordinate system, Area Co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirement.

Module-V. Static & Dynamic Analysis: Analysis of trusses and frames, Analysis of machine subassemblies, Use commercial software packages, Advantages and limitations Hamilton's principle, Derivation of equilibrium, Consistent and lumped mass matrices, Derivation of mass matrices for ID elements, Determination of natural frequencies and :node shapes, Use of commercial software packages.

Books:

1. Rao, S.S., The Finite Element Method in Engineering, 2nd ed., Peragarnon Press, Oxford.
2. Robert, D. Cook. David, S. Malkins, and Michael E. Plesha, Concepts andApplication of Finite Element Analysis 3 rd ed., John Wiley
3. Chandrupatla, T.R. anBelegundu, A.D., Introduction to Finite Elements inEngincering, Prentice Hall of India Pvt. Ltd.
4. Zienkiewicz OC, The Finite Element Method, 3rd ed, Tata Mc Graw Hill.

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COURSE OUTCOMES: At the end of the course the student will be able to:

CO1	Make use of finite element method to solve simple problems from Structural & Dynamic domain.
CO2	Develop the concept of various elements and their characteristics.
CO3	Create element and global stiffness, displacement and force matrices for ID and 2D FEA Problems.
CO4	Apply the finite Element analysis using available commercial FEA tools

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Jabalpur Engineering College, Jabalpur (M.P.)
B. Tech. V sem(AICTE) Mechatronics Engineering

(w.e.f. July 2021 Onwards)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
MT-502 (C)	Industry 4.0 & IIOT	70	20	10	-	-	100	3	1	-	4

Module I: Introduction to Industrial IoT (IIoT) Systems:

The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.

Module II: Implementation systems for IIoT:

Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.

Module III: IIoT Data Monitoring & Control:

IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

Module IV: Cyber Physical Systems:

Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

ModuleV: Industrial IoT- Applications:

Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

References:

1. Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress
2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
4. Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers

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COURSE OUTCOMES: At the end of the course the student will be able to

CO1	Knowledge of theory and practice related to Industrial IoT Systems.
CO2	Ability to identify, formulate and solve engineering problems by using Industrial IoT.
CO3	Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability

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(w.e.f. July 2021 Onwards)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
MT-503	Thermodynamics & Applications	70	20	10	30	20	150	3	-	2	4

Module I. Introduction of Thermodynamics :

Fundamentals - System and Control volume, Property, State & Process, Cycle, Temperature, Types of equilibrium, Zeroth law of thermodynamics, Temperature scales, Various thermometers, Heat & Work transfer.

Module II. The First Law of Thermodynamics:

Heat/work interaction in systems, First Law for Cyclic & Non-cyclic processes, Total energy, Various modes of energy, Internal energy and Enthalpy, First Law for Flow Processes, Steady state flow processes, Unsteady processes, Limitations of first law of thermodynamics.

Module III. The Second Law of Thermodynamics:

Second law-Kelvin-Planck and Clausius statements, Heat engine, Heat reservoir, Refrigerator, Heat pump, Thermal efficiency and COP, Reversible and irreversible processes, Carnot cycle, Internal and external irreversibility, Absolute temperature scale. Clausius inequality, Entropy, Entropy for solids, liquids, ideal gases undergoing various processes, Principle of increase of entropy, T-S diagrams, Irreversibility and Availability, Energy.

Module IV. Properties of Pure Substance:

Pure Substance, Phase, Phase-transformations, Formation of steam, Properties of steam, PVT surface, HS, TS, PV, PH, TV diagram, Processes of vapor, Measurement of dryness fraction, Use of Steam tables and Mollier chart.

Module V. Air Standard Cycles and Non-reactive Gas Mixture:

Carnot, Otto, Diesel, Dual cycles and their comparison, Brayton Cycle, PVT relationship, Mixture of ideal gases, Properties of mixture of ideal gases-Internal energy, Enthalpy and Specific heat of gas mixtures.

References:

1. P.K.Nag: Engineering Thermodynamics; TMH
2. VanGJ; Thermodynamics;John Wylen
3. CengelY: Thermodynamics; TMH
4. AroraCP, Thermodynamics TMH

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5. Omkar Singh Engineering Thermodynamics New Age International.
6. Radha Krishanan Engineering Thermodynamics PHI India Pvt. Ltd.
7. M.Achuthan Engineering Thermodynamics, PHIIndia.

COURSE OUTCOMES: At the end of the course the student will be able to

CO1	Analyze the laws of thermodynamics, and their applications
CO2	Explain working of heat engine, heat reservoir entropy, entropy change.
CO3	Explain Real gas, it's deviation with ideal gas Maxwell relations and their applications.
CO4	Analyze Pure Substance, phase, phase-transformations use of steam table and Mollier chart
CO5	Understand working of Air Standard cycles, Carnot, Otto, Diesel, Dual cycles

List of Experiments: MT503Lab

1. To find mechanical equivalent of heat using Joule's apparatus.
2. To study working of impulse and reaction steam turbine by models.
3. To study working of Gas turbines by models and to identify various processes of Brayton Cycle.
4. To calculate COP of vapor compression refrigeration system and to plot on T-s, p-H diagrams.
5. To plot specific fuel consumption versus rpm diagrams for diesel and petrol engines.
6. Study of 2 strokes and 4 stroke diesel engine.
7. Study of 2 stroke and 4 stroke patrol engine.

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
MT-504	Smart and Embedded Instruments	70	20	10	30	20	150	3	-	2	4

Module I: Principles of Electronics and Mechanical of Measurement and Instrumentation: Introduction to Instrumentation, Measurement Needs and Specifications, Calibration Procedures, Errors in Measurement, Uncertainty Analysis

Module II: Measurement of Physical Quantities: Vibration and Acceleration Measurement, Pressure Measurement, Vacuum Measurement, Temperature Measurement, Flow Measurement, Level Measurement, Density, Viscosity, and pH Measurement

Module III: Electrical Measurements: Introduction to Electrical Measurements, Analog Instruments: Galvanometers and Types, PMMC, Moving Iron, Dynamometer, and Induction Type Instruments, Extension of Ranges and Calibration of Ammeters & Voltmeters, Measurement of Resistance: Voltmeter-Ammeter Method, Ohmmeter, DC Bridges, Measurement of Inductance: AC Voltmeter Method, Maxwell's Bridge, Anderson Bridge, Measurement of Capacitance: Capacitance Bridges

Module IV: Application of Embedded Systems: Definition and History of Embedded Systems, Classification and Major Application Areas, Memory and Communication Interfaces, Embedded Processors: MCS-51, MCS-96, PIC, Motorola MC68H11, ARM Architecture, Introduction to RIO Architecture, Embedded Programming: Reading/Writing I/O, Hardware Delays, Application of aurdino systems, Lab VIEW Basics.

Module V: Embedded System Development and Tools: Embedded Software Development Trends Design: Trade Offs, Hardware-Software Co-design, Implementation, Integration, Testing, Embedded Software Development: Assembler, Cross Compiler, Simulators, Emulator, Debugger, IDE RTOS-Based Embedded System Design: Operating System Basics, Task Management, Task Communication/Synchronization, Introduction to FPGA and its Applications for High-Speed Data Acquisition and Control.

Books:

1. Raj Kamal Embedded Systems, TMH.
2. K.V.K.K. Prasad Embedded/ Real time systems: concepts, design & Programming-
3.Cooper W.D., Helfrick A.D. "Modem Electronic Instrumentation & Measurement", Prentice Hall.
4. A.K. Sawhney "Electrical and Electronics Measurements & Instrumentation", Dhanpat Rai & sons.
5. D.Patranabis "Industrial Instrumentation-"
6. A.K.Sawhney A Course on "Mechanical Measurements and Instrumentation" Dhanpat Rai & sons.

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

CO1	Understand measurement principles and formulate specifications effectively.
CO2	Select appropriate measuring equipment for various physical quantities.
CO3	Perform calibration procedures accurately to ensure reliable measurements.
CO4	Demonstrate proficiency in operating electrical instruments and identifying sources of errors.
CO5	Gain knowledge of embedded systems, including classification, application areas, and selection of processors and tools for development.

List of experiments: MT 504 Lab

1.Measure the vibration of a vibrating object using a piezoelectric accelerometer and analyze the data obtained.

2.Measure the pressure of a fluid using resistive and capacitive pressure pickups and compare the readings.

3. Measure the temperature of objects using thermocouples, RTDs, and thermistors, and compare the measurements.

4. Measure the flow rate of a liquid using a rotameter and an electromagnetic flowmeter and compare the readings.

5.Measure the level of a liquid in a tank using ultrasonic, capacitive, and microwave sensors, and compare the measurements.

6.Calibrate and verify the accuracy of electrical instruments such as ammeters and voltmeters.

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
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		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
MT-505	Machine Design	70	20	10	30	20	150	3	-	2	4

Module l. Stress concentration and fatigue:

Causes of stress concentration, stress concentration in tension, bending and torsion, reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage factor.

Module ll: Shafts:

Design of shaft under combined bending, twisting and axial loading, shock and fatigue factors, design for rigidity, design of shaft subjected to dynamic load, design of keys and shaft couplings.

Module III : Design of Bearings:

Sliding Bearing, hydrodynamics lubrication, mechanical aspects of bearing design, lubricants, journal bearing design, rolling element bearings.

Module IV: Brakes & Clutches:

Materials for friction surface, uniform pressure and uniform wear theories. Design of friction clutches: Disk, plate clutches, cone & centrifugal clutches. Design of brakes: Rope, band & block brake, Internal expending brakes, Disk brakes.

Module V : Design of Joints:

Design of Power screws types, screw drives, threaded joints efficiency, stresses in power screws, design procedure and calculation.

Reference Books:

1. Shigley J.E; Machine Design; TMH
2. Sharma and Purohit; Design of Machine elments; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher

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5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agrawal; Machine Design; Kataria & sons
7. Maleev; Machine Design

COURSE OUTCOMES: At the end of the course the student will be able to

CO1	Understand modes of failure, fatigue and different factors used in design.
CO2	Design cotter joints, knuckle joints and welded joints used in different machines..
CO3	Design shafts under combined bending, twisting and axial loading.
CO4	Select bearing for given conditions using design procedure.
CO5	Design different types of Power screws.

List of Experiments (MT-505 L):-

Design problems with drawing for

1.Design Shaft, journal bearing, brakes, clutches, joints & screws etc along with drawing.
2.Complete hands on problems of Design & Drawing of the subject.
3.Industrial application based Design problem.

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