Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	CE601	PEC	Professional Elective-I	70	20	10	-	-	100	3	1	-	4
2	CE602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	CE603	PCC	Structural Analysis-II	70	20	10	30	20	150	3	-	2	4
4	CE604	PCC	Structural Design and Drawing-II (Steel)	70	20	10	30	20	150	3	-	2	4
5	CE605	PCC	Environmental Engg.-I	70	20	10	30	20	150	3	-	2	4
6	CE606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	CE607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	EC608	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 EC608 for the award of Honours (Minor Specialization).									

Note:1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I		
S.No.	**Subject Code**	**Subject Name**
1	CE601A	Geographical Information System
2	CE601B	Natural Disaster Mitigation and Management
3	CE601C	Concrete Technology

List of Open Elective Course - II		
S.No.	**Subject Code**	**Subject Name**
1	CE602A	Basic Earthquake Engineering
2	CE602B	Waste Management
3	CE602C	Elements of FEM

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

DEAN Academic Jabalpur (M.P.)

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

B.Tech (AICTE), VI Semester

GEOGRAPHICAL INFORMATION SYSTEM

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Geographical Information System	CE 601 (A)	3	1	–	4

MODULE I : Definition of GIS, maps & GIS, digital representation of geographic data, data quality and data standards, raster and vector based data processing, digital tenain modeling, spatial analysis and modeling. remote sensing, its terminolory, electro magnetic signafures , atmospheric window. active and passive systems for remote sensing. remote sensing applications.

MODULE II : Principle of aerial photograph, flight planning, relief displacement of vertical photographs. stereoscope, parallax bar , methods of aerial photo visual interpretation keys by this instrument.

MODULE III : Principle of satellite image procurement, spectral reflectance curves, spatial, spectral, temporal, radiometric resolution characteristics of images, errors of satellite images & their rectification. methods of visual interpretation of satellite images.

MODULE IV : Projection, different types of projections and applications in image correction, projection used in India, measure of shortest distance between two points on the earth.

MODULE V : Remote sensing , technique used in resource management (soil, water,) & database management system (urban & rural planning) for civil engineering projects, global positioning system.

Reference Books:

1. Concept and Principle of Geographical Information system by: W.Yeung
2. Principle of Remote Sensing by Sabins
3. Manual of Remote Sensing by (A.S.R.S.) U.S.A.

B. Tech VI Sem — Civil Engineering

Course Articulation Matrix (6th Sem AICTE)														
SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Geographical Information System CE601A	CO 1	Process GIS raster and vector data for further spatial analysis and modeling.	1		2									2	
	CO 2	Compute measurements of various ground features through mathematical computations of aerial photograph.		2										2	
	CO3	Perform visual interpretation of satellite images in terms of different resolutions studied.		2		1								2	
	CO 4	Apply different projection systems for image correction and calculation of shortest distance.		2										2	
	CO 5	Illustrate remote sensing and GPS techniques for resource collection and database management.				2								2	

B.Tech (AICTE), VI Semester

NATURAL DISASTER MITIGATION AND MANAGEMENT

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Natural Disaster Mitigation and Management	CE601 (B)	3	1	-	4

MODULE I

Natural Disasters – Overview introduction. natural disasters around the world, naturai disaster risk assessment. earth and its characteristics.

MODULE II

Enviromental change and its degradation. climate change, global warming.

MODULE III

Plate tectonics & earthquakes: introduction and review natural disasters, principles. elements. and systems, geological. geo- morphological aspects. earthquake. geology, seismology, characteristics and dimensions. landslides.

MODULE IV

Critical climate system aspects and processes: oceanic. atmospheric and hydrologic cycles.

MODULE V

Mapping modeling risk analysis and loss estimation, natural disaster risk analysis. prevention and mitigation, applications of space technology, education and training, establishment of capacity building and along various stakeholders government education institute, use of multimedia, etc.

Reference Books

1. Edward A Keller' Robert Natural Hazards. pearson
2. Didas Natural Diasater. Dicrax Education

B. Tech VI Sem Civil Engineering

Course Articulation Matrix (6th Sem AICTE)															
SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Natural Disaster Mitigation and Management CE601B	CO 1	Summarize the causes of natural disaster and its preventive measures.	2						2					1	
	CO 2	Explain principles, elements and characteristics of natural disasters	2						2					1	
	CO3	Summarize critical climatic systems.	2						2					1	
	CO 4	Categorize different modelling methods for natural hazards assessment.	2						2						
	CO 5	Explain administrative mechanism for disaster mitigation.	2						2						

B.Tech (AICTE), VI Semester

CONCRETE TECHNOLOGY

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Concrete Technology	CE 601 (C)	3	1	-	4

MODULE-I

Introduction - Concrete as construction materials, Concrete making materials: Cement- Types and testing, Aggregates- various properties and testinlg, Water- quality for mixing and curing and use of sea water, Admixtures- functions and classification.

MODULE-II

Properties of fresh concrete, workability, factors affecting and measurement of workability, segregation, bleeding, setting time. process of mapufacturing of concrete, curing of concrete, strength of concrete, elasticity, creep, durability, corrosion and shrinkage.

MODULE-III

Concrete mix design - factors influencing mix prgportion , mix design by ACI method and I.S. code method, design of high strength concrete.

MODULE-IV

Testing of hardened concrete, compression flexure strength, tensile strength of concrete, comparison between cube and cylinder strength. non-destructive testing methods, test on composition of hardened concrete.

MODULE-V

Special concrete, lightweight concrete, fiber reinforced concrete, polymer-modified concrete, ferrocement, mass concrete, ready mix concrete, self compacting concrete.

Books References:

1. Shetty,'MS,Concrete Technology, Theory & Pr4ctice, S.Chand and Co,2004.
2: Gambhir, ML., Concrete Technology, Tata McGraw Hil, 20CI4.
3. Revile, Properties of Concrete, Longman Publishers,2004.
4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007

B.Tech (AICTE), VI Semester

BASIC EARTHQUAKE ENGINEERING

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Basic Earthquake Engineering	CE 602 (A)	3	–	-	3

MODULE I Interior of earth, plate tectonics, faults, consequences of earthquake, basic parameters of earthquake, magnitude & intensity, scales, seismic zones of India.

MODULE II Nature and characteristics of ground motion consequences of earthquake, ground rupture and ground failure, liquefaction, landslides, tsunamis, etc.

MODULE III Engineering seismology, evolution of Indian subcontinent waves generated by ground motion and their characteristics, body waves, longitudinal waves and transverse waves, surface waves, Rayleigh waves and love wave, attenuation of wave.

MODULE IV Distribution of earthquakes, global and Indian measurement of earthquakes: introduction of instruments used for measuring earthquakes: seismograph, accelerograph, various scales of magnitude, various scales of intensity, basic terms: fault line, focus, epicentre , epicentre distance, *f* focal depth, peak ground acceleration, etc.

MODULE V Introduction to earthquake resistant design and codal provisions.

References:

1. Introduction to Structural Dynamics - J.M. Biggs
2. Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran
3. IS: 1893 -2016 Criterion for Earthquake Resistant Design.
4. Structural Dynamics - Theory & computation - Mario Paz.
5. Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra.
6. Earthquake Resistant of Design of structures, Agarwal and Srikhande.
7. Earthquake Resistant of Design of structures, S.K. Duggal.

B. Tech VI Sem Civil Engineering

Course Articulation Matrix (6th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Basic Earthquake Engineering CE602A	CO1	implementation of Earthquake Engineering on engineering concepts which are applied in field Structural Engineering		2											
	CO2	diverse knowledge of earthquake engineering practices applied to real life problems			3										
	CO3	the theoretical and practical aspects of earthquake engineering along with the planning and design aspects			3										

B.Tech (AICTE), VI Semester

WASTE MANAGEMENT

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
B.Tech	Waste Management	CE602 (B)	L	T	P	3
			3	-	-	

MODULE-I Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules

MODULE-II Municipal solid waste management-fundamentals sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options.

MODULE-III Hazardous waste management – fundamentals characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects.

MODULE-IV Radioactive waste management – fundamentals sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal option.

MODULE-V Exposure pathway of pollutants emitted from recycling of e-waste, e-waste management rules of India (2011 and 2016 rules) e-waste management: case studies and unique initiatives from around the world.

References

1. Pichtel, John. Waste Management Practices: Municipal, Hazardous and Industrial. CRC Press, Taylor and Francis Group, 2005.
2. LaGrega, Michael D., Buckingham, Philip L. and Evans, Jeffrey C. Hazardous Waste Management. Waveland Press Inc., Reissue Edition, 2010.
3. Watts, Richard J. Hazardous Wastes - Sources, Pathways, Receptors. Wiley (1 Edition), 1998.

B. Tech VI Sem

Civil Engineering

Course Articulation Matrix (6th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Waste Management CE602B	CO 1	Classify solid waste by its physical, biological and chemical characteistrics.		2				3	2						
	CO 2	Apply proper methods of collection and conveyance to reduce solid waste.			2				2						
	CO3	Predict impact on socio economic enviroment				1			3						

B.Tech (AICTE), VI Semester

ELEMENTS OF FEM

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Elements of FEM	CE602 (C)	3	–	-	3

MODULE I : Calculus of variation, introduction to calculus of variations, introduction to equilibrium equations in elasticity, Euler's Lagrange's equations, principal of virtual work, virtual displacements, principle of minimum potential energy, boundary value, initial value problems, flexibility approach, displacement approach, different problems in structural analysis.

MODULE II : FEM procedure, derivation of FEM equations by variation principle polynomials, concept of shape functions, derivation for linear simplex element, need for integral forms, interpolation polynomials in global and local coordinates. weighted residual methods: concept of weighted residual method, derivation of FEM equationsnby Galerkin's method, Solving cantilever beam problem by Galerkin's approach, introduction of shape functions for CST triangular elements, rectangular elements, quadrilateral elements.

MODULE III : Concept of iso-parametric elements, concept of Jacobin matrix. numerical integration: numerical integration, one point formula and two point formula for 2D formula, different problems of numerical integration evaluation of element stiffness matrix.

MODULE IV : Pascal's triangle law for 3D shape function polynomials, shape function for beam elements, convergence: convergence criteria, compatibility requirements, characteristics of stiffness matrix, direct method for deriving shape functions using Langrage's formula, plane stress problems.

MODULE V : Analysis of structures: truss elements, analysis of truss problems by direct stiffness method. analysis of frames and different problems, different axi-symmetric truss problems.

Reference Books:

1. The Finite Element method -ZIENKIEWICZ.O.C.Tata McGraw Hill Pub. New Delhi, 2000
2. Finite Element Methods by C R Alaval , PHI
3. Finite element method with application in engineering by Chandrupatla & Belegundu, Pearson Publication.
4. Concepts and Applications of Finite Element Analysis: COOK. D. Robert. Malus.S.David, Plesha E. Michel, John wilely & sons 3rd Edn. New York, 2000
5. Finite Element Analysis -C.S. Krishnanmoorthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi
6. Introduction to the Finite Element method -Desai / ABEL-C.B.S. Publishers & Distributors, New Delhi

B.Tech (AICTE), VI Semester

STRUCTURAL ANALYSIS – II

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Structural Analysis –II	CE 603	3	–	2	4

MODULE I :
Moment distribution method in analysis of frames with sway, analysis of box frames, analysis of portals with inclined members, analysis of beams and frames by Kani's method.

MODULE II :
Plastic analysis of beams and frames.

MODULE III :
Analysis of tall frames, wind and earthquake loads, codal provisions for lateral loads. Approximate analysis of multistory frames for vertical and lateral loads.

MODULE IV :
Matrix method of structural analysis: force method and displacement method.

MODULE V :
Influence lines for indeterminate structures, Muller Breslau principle, Analysis of Beam-Columns.

Books for Reference:

1. Wang C.K. Intermediate Structural Analysis McGraw Hill New York
2. Kinney Streling J. Indeterminate structural Analysis. Addison Wesley.
3. Reddy C.S. Basic Structural Analysis, Tata Mc Graw Hill Pub. Co. New Delhi
4. Norris C.H. Wilbur J.B. and Utkys Elementary Structural Analysis, MC Graw Hill International Tokyo
5. Weaver W & Gere JM, Matrix Methods of Framed Structures, CBS Pub.& Dis. Delhi

STRUCTURAL ANALYSIS - II LAB

List of Experiments:

1. To obtain deflection at free end of a curved member consist of a "quadrant with straight edge" and to compare results with those obtained by using analytical solutions.
2. To obtain elastic deflection at free end of a "semicircular frame with straight edge" due to load applied at free end to compare results with those obtained using analytical solutions.
3. To obtain "influence line diagram" for intermediate reaction of a continuous beam of two unequal spans using "Muller-Breslau's Principle" and comparing the results with those obtained using analytical solution.
4. To obtain "influence line diagram" for End support reaction of a continuous beam of two equal spans using "Muller-Breslau's Principle" and comparing the results with those obtained using analytical solution.
5. To obtain force in members of a shear leg apparatus and to compare results with those obtained using analytical method.
6. Study of begg's deformeter.
7. Study of NDT Apparatus.

B. Tech VI Sem Civil Engineering

Course Articulation Matrix (6th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Structural Analysis-II CE603	CO 1	Analyze portal frames with sway and frames with inclined members.		3											
	CO 2	Calculate plastic moment capacity and collapse load for beams and frames subjected to different loading conditions.		2											
	CO3	Analysis of tall frames/ multistory buildings by approximate methods		2											
	CO 4	Analyze the beams and frames using matrix method of analysis.		3											
	CO 5	Draw ILD for support reaction, SF & BM at various sections for indeterminate structures.		2											
Structural Analysis-II Lab CE603	CO 1	Verify Max-well's reciprocal theorem	2												
	CO 2	Perform experiments to determine horizontal reaction for two and three hinged arch				2					1			1	
	CO3	Perform experiments to determine deflection and slope of beams and frames for various loading conditions.				2					1			1	

B.Tech (AICTE), VI Semester

STRUCTURAL DESIGN AND DRAWING – II (STEEL)

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Structural Design and Drawing – II (Steel)	CE604	3	–	2	4

MODULE 1: Various loads and mechanism of the load transfer, partial load factors structural properties of steel, design of structural connections-bolted, rivetted and welded connections.

MODULE 2 : Design of compression members, tension members, roof trusses - angular & tubular, lattice girders.

MODULE 3 : Design of simple beams built-up beams, plate girders and gantry girders.

MODULE 4 : Effective length of columns, design of columns- simple and compound, lacings and battens. design of footings for steel structures, grillage foundation.

MODULE 5: Design of industrial building frames, multi-storey frames, bracings for high rise structures. design of transmission towers.

Note : All the designs for strength and serviceability should strictly be as per the latest version of IS:800.

Books for Reference:

1. Design of Steel Structures by Subramanium
2. Design of Steel Structures by Duggle
3. Design of Steel Structures by Bhavi Katti

Structural Design and Drawing – II (Steel) LAB

List of Experiments:

1. Design & drawing of structural connection.
2. Design & drawing of members of roof trusses.
3. Design & drawing of beams & Plate Girders.
4. Design & drawing of build up Columns.
5. Design & drawing of Footing.

B. Tech VI Sem Civil Engineering

Course Articulation Matrix (6th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Structural Design and Drawing II (Steel) CE 604	CO 1	Identify various loads, mechanism of load transfer and design of structural connections for Steel.		2											
	CO 2	Design truss members, girder, other structural memCEr for steel buildings and transmission tower			3									2	
	CO3	Explain different types of building frames and bracing systems			3									2	
	CO 4	Apply effective length of column, lacing and battens			3									2	
Structural Design and Drawing II (Steel) Lab CE604	CO 1	Identify the major steps and symbol used in civil engineering drawings .	2												
	CO 2	Draw civil engineering drawing for different connections used in steel structures	2				1								
	CO3	Draw civil engineering drawing for different structural elements for steel	2				1								

B.Tech (AICTE), VI Semester

ENVIRONMENTAL ENGG – I

Course	Subject Title	Subject Code	Contact Hours Per week			Total Credits
			L	T	P	
B.Tech	Environmental Engg - I	CE605	3	—	2	4

MODULE-I

Estimation of ground and surface water resources, quality of water from different sources, demand & quantity of water, fire demand, water requirement for various uses, fluctuations in demand, forecast of population.

MODULE-II

Impurities of water and their significance, water-bome diseases, physical, chemical and bacteriological analysis of water, water standards for different uses. Intake structure, conveyance of water, pipe materials, pumps operation & pumping stations.

MODULE-III

Water treatment methods theory and design of sedimentation, coagulation, filtration, disinfection, aeration & water softening, modern trends in sedimentation & filtration, miscellaneous methods of treatment.

MODULE-IV

Layout and hydraulic design of different distribution systems, pipe fittings, valves and appurtenances, analysis of distribution system. Hardy Cross method, leak detection, maintenance of distribution systems, service reservoir capacity and height of reservoir.

MODULE-V

Rural water sypply schemes, financing and management of water supply project, water pollution control act, conservancy & water carriage system, sanitary appliance and their operation, building drainage system of plumbing.

Books for Reference:

1. Water Supply & Sanitary Engg. By G.S. Birdi-Laxmi publications (p) Ltd. New Delhi
2. Water & Waste Water Technology by Mark J.Hammer Prentice - Hall of India, New Delhi
3. Environmental Engineering - H.S. Paeavy & D.R. Rowe Mc Graw Hill Book Co. New Delhi
4. Water & Waste Water Technology G.M. Fair & J.C. Geyer.

ENVIRONMENTAL ENGINEERING – I - LAB

List of Experiments:

1. To study the various standards for water
2. To study of sampling techniques for water
3. Measurement of turbidity
4. To determine the coagulant dose required to treat the given turbid water sample
5. To determine the conc. of chlorides in a given water samples.
6. Determination of hardness of the given sample.
7. Determination of residual chlorine by chloroscope.
8. Determination of Alkalinity in a water samples
9. Determination of Acidity in a water samples
10. Determination of Dissolved oxygen in the water sample.

B. Tech VI Sem

Civil Engineering

Course Articulation Matrix (6th Sem AICTE)

SUBJECT NAME	COs	STATEMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
Environment Engineering-I CE605	CO 1	Compare the quality of raw water from various resources and calculate water demand based on population forecast.	1					1	1						
	CO 2	Explain physical, chemical and biological drinking water standards.	2					1							
	CO3	Design Water treatment units for treatment of raw water			3										
	CO 4	Design Water distribution system including hydraulic layout, leak detection and maintenance.			2										
	CO 5	Explain water pollution control act and operation of sanitary appliance	1					1	2						
Environment Engineering-I Lab CE605	CO 1	Examine quality of raw water from various resources.		2				2			1				
	CO 2	Analyze physical, chemical and biological drinking water standards.		2				3			1				

Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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	
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2	CS602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	CS603	PCC	Software Engineering	70	20	10	30	20	150	3	-	2	4
4	CS604	PCC	Machine Learning	70	20	10	30	20	150	3	-	2	4
5	CS605	PCC	Computer Networks	70	20	10	30	20	150	3	-	2	4
6	CS606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	CS607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	CS608	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 CS608 for the award of Honours (Minor Specialization).									

Note:1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I

S.No.	Subject Code	Subject Name
1	CS601A	Image Processing
2	CS601B	Parallel Computing
3	CS601C	Robotics

List of Open Elective Course - II

S.No.	Subject Code	Subject Name
1	CS602A	Wireless Sensor Networks
2	CS602B	Mobile Computing
3	CS602C	Microprocessor

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

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) VI Sem. (Computer Science & Engineering)

CS 601 (Professional 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 601A	Image Processing	70	20	10	—	—	100	3	1	0	4

Module I: Digital Image Fundamentals:
Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures

Module II: Intensity transformation and filtering:
Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domainsharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency, domain filters – low-pass and high-pass.

Module III: Color Image Processing:
Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Module IV: Image Compression:
Fundamentals, Huffman Coding, Arithmetic Coding, LZW coding, Bit plane Coding, Symbol Based Coding, Block Transform Coding (walsh-Hadamard transform Discrete Cosine Transform), Wavelet Coding.

Module V: Mathematical morphology:
Erosion,Dilation,Duality,Openingandclosing,Hit-or-miss transformation, Boundary Extraction, Hole Filling, Extraction of Connected Components, convex Hull, Thinning, Thickening, Skeletons, Pruning.
Image Segmentation: Point, Line and Edge Detection, Thresholding, Region based Segmentation.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods "Digital Image Processing" Pearson.
2. Milan Sonka and Vaclav Hlavac and Roger Boyle "Image Processing, Analysis and Machine Vision" Springer-Science.
3. Anil Kumar Jain "Fundamental of Digital Image Processing" pearson education.
4. Rafael C. Gonzalez, Richard E. Woods , "Digital Image Processing Using MATLAB", Mc Graw Hill India.

15/7/19 15/7/19 15/7/19 15/7/19

Subject: Image Processing (CS 601A)

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

CO1. Explain digital image fundamentals.
CO2. Apply image enhancement, filtering and restoration techniques.
CO3. Analyze image compression and segmentation Techniques.
CO4. Design/develop an implementation model based on various image features.

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

CS 601 C Professional 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 601B	Parallel Computing	70	20	10	-	-	100	3	1	-	4

Module I : Introduction:
Parallel computing, scope of parallel computing, Abstract model of serial & parallel computation, pipelining, data parallelism, control parallelism, scalability , topologies in processor organization, parallel computing design consideration , parallel algorithms & parallel architectures, applications of parallel computing .

Module II : Memory Architecture:
Shared memory multiprocessors (UMA-Uniform memory Access), Distributed memory multiprocessors (NUMA- Non Uniform memory Access), SIMD, Systolic processor ,Cluster computing, Grid computing, Multicore Systems .

Module III : Introduction to Parallel Algorithms:
Introduction to parallel algorithms, parallel algorithm models, Decomposition Techniques, characteristics of tasks & interactions, mapping techniques for load balancing, methods for containing interaction overheads.

Module IV: Parallel Algorithms:
Matrix multiplication, parallel reduction, parallel sorting : bubble, quick sort, Graph algorithm: Minimum spanning tree(prim's algorithm),Fast Fourier transform: serial algorithm, transpose algorithm .

Module V : Parallel Programming Models & Performance Measures:
Paradigms, parallel programming models, shared memory programming, message passing programming , MPI , PVM ,Threads. Sources of overhead in parallel programs , performance metrics for parallel systems , effect of granularity &data mapping on performance , scalability of parallel systems ,analysis of parallel programs .

Suggested Books:

1. Ananth Grama ,George Karypis, Vipin Kumar, Anshul Gupta. "Introduction to Parallel Computing", Addison.
2. Fayez Gebali , "Algorithms and Parallel Computing ", Wiley India.
3. M.Sasikumar , Dinesh shikhare, P. Ravi Prakash , "Introduction to parallel processing " Eastern Economy edition.
4. P. Venkata Krishna, Ane's Student Edition , "Principles of Grid computing ", Ane Books Pvt Ltd.

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PARALLEL COMPUTING (CS601B)

CO1 : Explain various concepts associated with parallel computing environment.

CO2 : Analysis of parallel program, serial and parallel algorithm model, parallel sorting and mapping techniques.

CO3 : Evaluate parallel algorithms, models and programming models in terms of performance measures.

CO4 : Design memory architecture of multiprocessors and parallel algorithm.

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)

CS 601 (Professional 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 601C	Robotics	70	20	10			100	3	1	0	4

Module I: Introduction:
Classification of Robots, Basic Robot Components, Manipulator End Effectors, Controller, Power Unit, Sensing Devices, Specification of Robot System, Accuracy Precision and Repeatability. Coordinate Systems: Cartesian Coordinates, Transformation Matrices, Reference Frame Transformations, Orientation, Inverse Transformations, and Graphs.

Module II: Robotic Sensing Devices:
Position, Velocity and Acceleration Sensors, Proximity and Range Sensors, Touch and Slip Sensors, Tectile Sensors, Force and Torque Sensors. Robotic Vision System: Imaging Components Picture Coding, Object Recognition, Training and Vision Systems, Review of Existing System.

Module III: Robotics Programming:
Methods of Robotics Programming, Types of Programming, Robotics Programming Language, Artificial Intelligence. Robot Application: Material Transfer and Machine Loading Unloading, Processing Applications, Welding and Painting Assembly and Inspection, Future Robotic Application and Related Technologies Development.

Module IV: Image Identification:
Lenses, Vidicon Tube, Solid-State Vision System, Image Process Binary Image Analysis Identification, The Transformation. Actuators and Power Transmission Devices: Pneumatic and Hydraulic Actuators, Electrical Actuators, Power Transmission Trajectory Planning & Control: Manipulator Equations of Motion Manipulator Control, The Measure of the Robot.

Module V: Control:
Basic Concepts in Control Systems, Digital Control for Positions. System Integration: Mechanism, Actuators and Sensors.

Suggested Books:

1. J.craig, "Introduction to Robotics" Addision Wesley.
2. Klafter, chemielwski and nagrin, "Robotics Engineering", Prentice hall.
3. Robert J. Schiling, "Fundamental of Robotics analysis and control", Pearson education.
4. K. S. Fu, R.c. Gonzalez, C.S.g lee, "Robotics" TMH.

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ROBOTICS (CS601C)

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

CO1 : Define various fundamental concepts of robotics such as robot and its components, co-ordinate system, robotic sensing, image identification, vision system, control system, robot programming and applications.

CO2 : Classify and compare various sensors, sensing devices, robot programming methods, transmission devices and control systems.

CO3 : Experiment with programming samples, control rules and parameters with available hardware and software.

CO4 : Evaluate mathematic and programming problems of various robotic concepts.

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)

CS602 (Open Elective-II)

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 602A	Wireless Sensor Networks	70	20	10	-	-	100	3	-	-	3

Module I: Fundamentals:
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Module II: Ad hoc networks:
Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Module III: Routing:
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Module IV: Data dissemination:
Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Module V: Design :
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Suggested Books:

1. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication.
3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications.
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press.

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WIRELESS SENSOR NETWORK (CS602A)

CO1 : Explain concepts of wireless sensor network, Ad-hoc networks, Routing protocol and data dissemination.

CO2 : Apply sensor network on various sensor network platforms, tools and applications.

CO3 : Analyze the protocol design issues of Ad-hoc network and challenges in designing MAC routing and transport protocols for wireless Ad-hoc / sensor networks.

CO4 : Design WSN hardware components, single mode architecture and gateway using various WSN OS.

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(AICTE Model Curriculum based scheme)
CS 602 (Open Elective-II) **B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)**

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 602B	Mobile Computing	70	20	10	—	—	100	3	0	0	3

Module I: Signal propagation:
Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading.
Capacity of flat and frequency selective channels. Antennas- Antennas for mobile terminal monopole antennas, PIFA, base station antennas and arrays

Module II: Multiple access schemes:
FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK, multicarrier modulation, OFDM

Module III: Cellular concepts:
Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards, GSM, EDGE, GPRS, CDMA 2000 and WCDMA, 4G networks and LTE.

Module IV: Mobile layers:
Mobile network layer - Mobile IP – Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Adhoc Networks – Routing Strategies
Mobile transport layer - Congestion Control – Implication of TCP Improvement – Mobility – Indirect – Snooping – Mobile – Transaction oriented TCP - TCP over wireless – Performance.

Module V: Mobile environment processing and personal area networks:
Personal Area Network: Bluetooth and ZigBee.
Mobile Databases and transaction, file system for mobile environment, Mobile agents, Security of mobile computing and transaction processing in mobile computing environment.

Suggested Books:

1. J. Schiller, "Mobile Communications", Pearson Education, Delhi.
2. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer.
3. PeiZheng, Lionel Ni, "Smart Phone and Next Generation Mobile Computing", (Morgan Kaufmann Series in Networking) , Elsevier.
4. Hansmann, LotharMerk, Martin Niclous, Stober, "Principles Of Mobile Computing", Dreamtech Press.
5. WCY Lee, "Mobile Communications Design Fundamentals", Prentice Hall.
6. AJ Viterbi, "CDMA: Principles of Spread Spectrum Communications", Addison Wesley.
7. VK Garg&JE Wilkes, "Wireless & Personal Communication Systems", Prentice Hall.
8. Paolo Bellavista and Antonio Corradi (Eds.), "Handbook of Mobile Middleware", Auerbach Publication.
9. Reza B'Far (Ed), "Mobile Computing Principles", Cambridge University Press.
10. ZhiNing Chen &Kwai-Man Luk, "Antennas for Base Stations in wireless communications", TMH.

Mobile Computing (CS 602B)

Course Outcomes (COs)

CO1) Explain the functionality of mobile network and transport layer.
CO2) Classify different types of mobile communications system and Antennas.
CO3) Analyze security, mobility, scalability, and their unique characteristics in wireless networks.
CO 4) Design frequency reuse and number of channel in cellular networks.

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)

CS 602 (Open Elective - II)

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 602C	Microprocessor	70	20	10			100	3	-	-	3

Module I: Introduction to Microprocessor:
History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

Module II: Assembly Language Programming and Timing Diagram:
Assembly language programming in 8085, Macros, Labels and Directives, Microprocessor timings, Microinstructions, Instruction cycle, Machine cycles, T states, State transition diagrams, Timing diagram for different machine cycles.

Module III: Serial I/O, Interrupts and Data Transfer techniques:
Serial I/O using SID, SOD. Interrupts in 8085, Issues in implementing interrupts, Multiple interrupts and priorities, Daisy chaining, Interrupt handling in 8085. Programmed data transfer, Parallel data transfer using 8155. Asynchronous and Synchronous data transfer using 8251A. Programmable interrupt controller 8259A. DMA transfer, cycle stealing and burst mode of DMA, 8257 DMA controller.

Module IV: Microprocessor Interfacing Techniques:
Interfacing memory and I/O devices, Addressing memory, interfacing static RAMs, Interfacing and refreshing dynamic RAMs, Interfacing a keyboard, Interfacing LED and seven segment displays, interfacing a printer, Interfacing A/D converters, D/A converters.

Module V: Microcontrollers:
Types of Microcontrollers – Criteria for selecting a microcontroller - Example Applications, 8051 Architecture, Register Organization, 8051 Addressing Modes, Different types of instructions and Instruction Set, Simple Programs, Introduction to Pentium and further series of microprocessors.

Suggested Books

1. R. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Penram.
2. Bhurchandi and Ray, Advanced Microprocessors and Peripherals, Third Edition McGraw Hill.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design,Pearson Education.
4. Douglas V. Hall, SSSP Rao, Microprocessors and Interfacing, Third Edition, McGrawHill Education.
5. K. J. Ayala, The 8051 Microcontroller Architecture, Programming and Applications, Penram.

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MICROPROCESSOR (CS602C)

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

CO1 : Understand the internal architecture and organization of 8085 / 8086 and 8051 microcontroller, different addressing modes and instructions of 8085 / 8086 & 8051 microcontroller, serial I/O, interrupts and data transfer techniques.

CO2 : Analyze the assembly language programming and timing diagram of 8085 / 8086.

CO3 : Apply the interfacing concept of different peripherals (8255, 8253 etc) with microprocessors and microcontrollers for real time applications.

CO4 : Compare accepted standards and guidelines to select appropriate microprocessors (8085 & 8086) and microcontroller to meet specified performance requirements.

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)

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 603	Software Engineering	70	20	10	30	20	150	3	0	2	4

Module I: Introduction:
Phases in Software development, Software Development Life Cycle (SDLC), software development process models Software process models (Linear Sequential Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, and Rational Unified Process), Agile process.

Module II: Software Requirement specification (SRS):
Role of SRS, Requirements gathering and problem analysis, requirement specification, validation of SRS document. Use cases: Use case modelling, Use case diagram and use case documents/specifications.

Module III: Object-Oriented Modeling (using UML):
Analysis Modeling, Developing Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram. System and Subsystem Design, Design goals, Design Patterns.

Module IV: Software Testing:
Unit testing, Integration testing, System testing, Regression testing, Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis.

Module V: Software Project Management:
Software Project Planning, Cost Estimation, Scheduling, Risk Management, Quality Management, Software Change Management, Software Configuration Management, Re-engineering, Reverse Engineering, Project Plan

Suggested books:

1. R S. Pressman ,"Software Engineering: A Practitioner's Approach", McGraw-Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning.
3. Sommerville,"Software Enginerring", Pearson Education.
4. Grady Booch, Robart A. Maksimchuk, Michael W. Engle, Bobbij Young, Jim Conallen, and Kellia Houston, "Object Oriented Analysis & Design with Applications" , Pearson Education India.
5. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa.
6. Bernd Bruegge, Allen Dutoit: "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Prentice Hall.
7. Blaha and Rumbaugh. "Object-Oriented Analysis and Modeling using UML",TMH.

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Subject: Software Engineering (CS 603)
Course Outcomes (COs): After successful completion of the course, the students will be able to:

CO 1) ~~Understand and~~ Explain concepts of software engineering such as SDLC and software process models, SRS, UML models (or Software Artefacts), software testing and software project management.

CO 2) Analyse SRS/problem specifications to extract relevant domain elements such as domain class, class attributes, operations and relationships between classes

CO 3) Develop the use case models, analysis level class diagram and sequence diagrams for the given problem

CO 4) Design UML models such as Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram and test cases for a given software problem

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)

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 604	Machine Learning	70	20	10	30	20	150	3	0	2	4

Module I: Introduction:
Basic Concepts, Understand and Formalize the Learning Problem, Model and Parameters, Training, Validation and Test Data. Types of Learning: Supervised learning, Unsupervised Learning, Semi-Supervised Learning Reinforcement Learning and Deep Learning. Machine Learning Application Areas, Present and Future

Module II: Supervised Learning:
Classification, Linear Regression, Linear Regression of One Variable using Gradient Descent Algorithm, Linear Regressions of Multiple Variables using Gradient Descent Algorithm. Logistic Regression. Decision Trees, Ensemble Learning – Boosting – Bagging, Naive Bayes Classifier, k-Nearest Neighbors Classifier.

Module III: Unsupervised Learning:
Hierarchical Clustering, k-Means Clustering, Mixture Models, Density-Based Spatial Clustering of Applications with Noise (DBSCAN), Ordering Points to Identify the Clustering Structure (OPTICS)

Module IV: Introduction to Deep Learning:
Perceptrons, Basic Neural Network Structure, Simple Examples and Motivation for Deep Networks, Forward Propagation, Cost Functions, Error Backpropagation Algorithm, Training by Gradient Descent, Fundamental concepts of Kohonen and Grossberg Network, Convolution Neural Network, Recurrent Neural Networks, Long/Short Term Memory

Module V: Evaluation and Practical Issues in Machine Learning:
High Dimensionality, Importance of Good Features, Irrelevant and Relevant Features, Feature Pruning and Normalization, Evaluating Model Performance, Hypothesis Testing and Statistical Significance, Accuracy, Precision, Recall, Confusion Matrix, Bias Variance Ttradeoffs, Overfitting, Underfitting.

Suggested Books:

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", CRC Press.
2. Chapman and Hall, " Machine Learning and Pattern Recognition Series", CRC Press.
3. Tom M Mitchell, "Machine Learning", McGraw Hill Education.
4. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press.
5. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", Wiley.
6. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)" , MIT Press.
7. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press.

Machine Learning (CS 604)

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

CO 1) ~~Understand and~~ Explain concepts of machine learning such as models, types of learning, performance measurement metrics and practical issues in machine learning.

CO 2) Apply an appropriate machine learning strategy for solving a given problem

CO 3) Compare different machine learning approaches for the given data

CO 4) Design a machine learning model for basic real world problems

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI Sem. (Computer Science & Engineering)

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 605	Computer Networks	70	20	10	30	20	150	3	-	2	4

Module-I: Computer Network:
Definitions, Goals, Components, Architecture, Classifications & Types. Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service primitives, Design issues & its functionality, ISO OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Network standardization. Queuing Models: Little's Theorem, Queuing System: M/M/1, M/M/m, M/M/∞, M/M/m/m, M/G/1.

Module-II: Data Link Layer:
Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol. Elementary & Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Bit oriented protocols: SDLC, HDLC, BISYNC, LAP and LAPB. Protocol verification: Finite State Machine Models & Petri net models.

Module-III: MAC Sub layer:
MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bit Map, BRAP, Binary Count Down, MLMA. Limited Contention Protocols: Adaptive Tree Walk, URN Protocol, High Speed LAN: Fast Ethernet, Gigabit Ethernet, FDDI, Performance Measuring Metrics. IEEE Standards 802 series & their variant.

Module-IV: Network Layer:
Need, Services Provided , Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing, Congestion Control Algorithms: General Principles of Congestion control, Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram subnets. IP protocol, IP Addresses, Comparative study of IPv4 & IPv6, Mobile IP.

Module-V: Transport Layer:
Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Session layer: Authentication, Authorization, Session layer protocol (PAP, SCP, H.245). **Presentation layer**: Data conversion, Character code translation, Compression, Encryption and Decryption, Presentation layer protocol (LPP, Telnet, X.25 packet Assembler/Disassembler). **Application Layer**: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP). Study of internetworking devices and their configuration- Switches, Hubs, Bridges, Routers and Gateways etc.

Suggested Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks" Pearson Education.
2. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication.
3. Uyless Black, "Computer Networks", PHI Publication, Second Edition.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill.

Subject - Computer Networks (CS 605)

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

CO1: Explain OSI and TCP/IP Protocol based reference model used for constructing Computer Network.
CO2: Construct Computer Network using Data Link Layer protocol and MAC Layer protocol.
CO3. Compare Routing Strategies, Networks Configuration and various protocols
CO4. Design Computer Network by using efficient protocols and internetworking devices.

Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	EC601	PEC	Professional Elective - I	70	20	10	-	-	100	3	1	-	4
2	EC602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	EC603	PCC	Linear Control Theory	70	20	10	30	20	150	3	-	2	4
4	EC604	PCC	Digital Signal Processing	70	20	10	30	20	150	3	-	2	4
5	EC605	PCC	Microwave & RADAR Engg.	70	20	10	30	20	150	3	-	2	4
6	EC606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	EC607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	EC608	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 EC608 for the award of Honours (Minor Specialization).									

Note:1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective Course-I

S.No.	Subject Code	Subject Name
1	EC601A	Data Communication
2	EC601B	Wireless Communication
3	EC601C	Mobile Standards

List of Open Elective Course - II

S.No.	Subject Code	Subject Name
1	EC602A	Satellite Communication
2	EC602B	Simulation & Modeling
3	EC602C	Robotics

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

DEAN Academic JEC, Jabalpur (M.P.)

Principal Jabalpur Engineering College

Jabalpur Engineering College, Jabalpur
(AICTE Model Curriculum based scheme)
B. Tech. (AICTE) VI 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					
EC601A	(PEC-I) Data Communication	70	20	10	-	-	100	3	1	-	4

MODULE I
INTRODUCTION TO INTERNET: Network edge, end systems, clients, servers, connectionless and connection oriented services, Network code, Access networks, ISPs and internet backbone, Delay and loss in packet switched network. LAYERED ARCHITECTURE: Protocols services and layering, OSI reference model, overview of TCP/IP, Berkeley API, Introductory socket programming in C, Application layer protocols and TCP/IP utilities.

MODULE II
DATA LINK LAYER: Peer-to-peer protocols and service models, ARQ protocols and reliable data transfer service, stop-and wait, go-back-N, selective reject, sliding window flow control, timing recovery for synchronous service, Data link controls: Framing , HDLC data link control, link sharing using packet multiplexers.
MEDIUM ACCESS CONTROL: Random access, ALOHA, Slotted ALOHA, CSMA, CSMA CD, Scheduling approaches to medium access control, reservation systems, polling, token-passing rings, comparisons, Delay performance of MAC: Performance of channelization with bursty traffic, performance of polling and token ring, random access and CSMACD. Local area networks: LAN protocols, Ethernet, token ring, wireless LAN and IEEE 802.11 standard, Logical Control, Wi Fi Standard, 802.11x, 802.15, 802.16,

MODULE III
PACKET SWITCHING NETWORKS: Packet network topology, datagram's and virtual circuit, routing in packet networks, Shortest-path routing, ATM networks, traffic management at packet level, traffic management at flow level, traffic management at the flow-aggregate level, x.25 and Internet Protocol, TCP reliable stream service and flow control.

MODULE IV

TCP/IP: Architecture and protocol, IP packet, addressing, subnet, IP routing, CIDR, address resolution, reverse address resolution, fragmentation and reassembly, ICMP, IPv6, UDP, Transmission control protocol, internet routing protocols, multicast routing, DHCP, NAT and mobile IP. Port concept.

MODULE V
Session presentation, Application presentation session Protocol, Internet sensitivity and role of different Keys and Algorithm and http, https techniques, general application layer services,

Text Book:

1. Communication Networks, 2 ed., A Leon-Garcia, I Widjaja, McGraw Hill Education India.
2. Computer Networking: A top down approach, 5 ed., J F Kurose, K W Ross, Pearson Education.
3. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.

Reference Books:

1. Data Networks, 2 ed, D P Bertsekas, R G Gallagar, Prentice Hall.
2. Analysis of Computer and Communication Networks, F Gebali, Springer 2008.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Classify various type of data communication network
CO2	Analyze design constraints of physical layer
CO3	Analyze various error detection and correction technologies
CO4	Design various addressing mechanism
CO5	Analyze various types of connecting devices

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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					
EC601B	(PEC-I) Wireless Communication	70	20	10	-	-	100	3	1	-	4

MODULE I

WIRELESS CHANNELS Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

MODULE II

CELLULAR ARCHITECTURE Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking& grade of service – Coverage and capacity improvement.

MODULE III

DIGITAL SIGNALING FOR FADING CHANNELS Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

MODULE IV

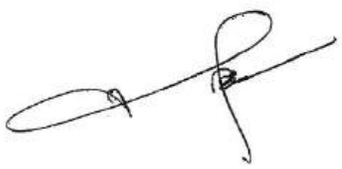
MULTIPATH MITIGATION TECHNIQUES Equalisation – Adaptive equalization, linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

MODULE V

MULTIPLE ANTENNA TECHNIQUES MIMO systems – spatial multiplexing -System model - Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information- capacity in fading and non-fading channels.

Course Outcomes

CO1	To characterize various Wireless Channels.
CO2	To understand various encoding schemes for fading channels.
CO3	To understand fundamental concepts related to digital signaling for fading channels.
CO4	Compare multipath mitigation techniques and analyze their performance.
CO5	To implement system consisting a transmitter/receiver segment of MIMO systems and analyze their performances.



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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC601C	(PEC-I) Mobile Standards	70	20	10	-	-	100	3	1	-	4

Module 1

Cellular Mobile Wireless Networks: Systems and Design Fundamentals, Propagation Models Description of cellular system, Frequency Reuse, Cochannel and Adjacent channel interference, Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication, Models for Multipath Reception. Evolution of Modern Mobile Wireless Communication System - First Generation Wireless Networks, Second Generation (2G) Wireless Cellular Networks, Major 2G standards, 2.5G Wireless Networks, Third Generation 3G Wireless Networks, Wireless Local Area Networks (WLANs), Cellular –WLAN Integration, AllIP Network: Vision for 4G

Module 2

GSM: Architecture and Protocols - Air Interface, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multiframe, Control (Signaling) Channel Multiframe, Frames, Multi-frames, Super-frames and Hyper-frames, GSM Call Set up Procedure, GSM Protocols and Signaling, Location Update Procedure, Routing of a call to a Mobile Subscriber

2.5G Networks - The General Packet Radio Services: (GPRS) - GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Logical Channel, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer Through GPRS Network and Rout, GPRS Location Management Procedures, GPRS Roaming, The IP Internetworking Model, GPRS Interfaces and Related Protocols, GPRS Applications

Module 3

Overview of CDMA systems: IS-95 Networks 3G – The Universal Mobile Telecommunication System (UMTS) - UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTS downlink transport and physical channels, UMTS uplink transport and physical channels UMTS Time Slots, UMTS Network Protocol Architecture, Mobility Management for UMTS Network

Module 4

Overview Mobile Internet Protocol: Basic Mobile IP, Mobile IP Type-MIPV4 and MIPv6, Mobile IP: Concept, Four basic entities for MIPv4, Mobile IPv4 Operations, Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing, Problems and Limitations of MIP, MIPv4 Route Optimization

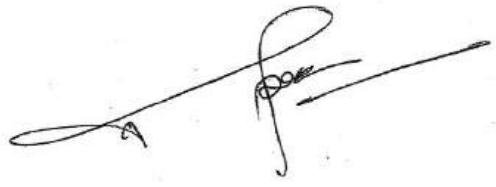
Module 5

Mobility Management Issues: Role of IP on Wireless Networks - IP for GPRS and UMTS R99, Protocol Reference Model for UMTS PS domain, Packet Switched Domain Protocol Stacks: Role of Interfaces, The GTP Tunnel, The Iu-PS Interface and Mobility Management, Packet routing and transport of user data in UMTS network, Configuring PDP Addresses on Mobile

Stations, Mobility Management in Wireless Networks, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution. Accessing External PDN through GPRS/UMTS PS Domain, Transparent Access, and Use of Mobile IP for Non-transparent access, dynamically accesses IP address from External Network.

Course Outcomes

CO1	To assess the cellular system capacity
CO2	To assess the performance of 2G and 2.5G cellular standards.
CO3	To learn the various modules of CDMA system.
CO4	Acquire various concepts related to mobile protocols
CO5	Learn the concepts require understandingof mobile management issues.



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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC602A	(OEC-II) Satellite Communication	70	20	10	-	-	100	3	-	-	3

MODULE I
Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

MODULE II
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation-performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

MODULE III
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption

MODULE IV
Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain.

MODULE V
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- Worldspace services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet

TEXT BOOKS:

1. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
2. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.
3. Satellite Communication by Dr. P. C. Agarwal, Khanna Publishers 2009
4. Design of Geo synchronous Space craft, PHI 1986

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Identify the fundamental concept of satellite communication, orbits and eclipses.
CO2	Acquire the knowledge to understand the importance of satellite subsystem for link budget analysis
CO3	To Evaluate the significance of various modulation techniques
CO4	To Learn the techniques for analysis of earth station technologies.
CO5	To Analyze the working and functionalities of various satellites.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC602B	(OEC-II) Simulation & Modeling	70	20	10	-	-	100	3	-	-	3

MODULE - I

Introduction: Simulation: When to Apply, Advantages and disadvantages of Simulation; Areas of application, System and Its components; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation, Simulation examples: Simulation of queuing systems.

Principles, Simulation Software: Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling

MODULE - II

Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, discrete distributions, continuous distributions, Poisson process, Empirical distributions.

Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems, Steady-state behavior of M/G/1 queue, Networks of queues

MODULE - III

Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers.

Random-Variate Generation: Inverse transform technique Acceptance-Rejection technique.

MODULE - IV

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.

Estimation of Absolute Performance: Types of simulations with respect to output analysis, stochastic nature of output data, Measures of performance and their estimation.

MODULE -V

Measures of performance and their estimation, output analysis for terminating simulations, output analysis for steady-state simulations.

Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation.

Text Reading:

- Jerry Banks and John Carson, "Discrete Event System Simulation", Fourth Edition, PHI, 2005.
- Geoffrey Gordon, "System Simulation", Second Edition, PHI, 2006 (Unit – V).

• Frank L. Severance, "System Modeling and Simulation", Wiley, 2001.
• Averill M. Law and W. David Kelton, "Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
• Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice", Wiley, 1998.
• Sheldon M. Ross: Introduction to Probability Models 7th Edition, Academic Press, 2002
• Donald E. Knuth: The Art of Computer Programming - Volume 2: Semi Numerical Algorithms, 2nd Edition, PEARSON
• Sheldon M. Ross: Simulation 3rd Edition, Academic Press, 2002
• M. Law and W. D. Kelton. Simulation Modeling and Analysis, 3rd Edition, McGrawHill, New York, USA, 1998

COURSE OUTCOMES

At the end of the course students will be able to:-

CO1	Students able to explain Simulation Principles and develop the capability to apply Simulation through oftware
CO2	Students able to explain and differentiate different types of Modeling.
CO3	Student able to Understand different methods for random number generation
CO4	Students able to Explain and design different types of Input Modeling.
CO5	Students able to Analyse ,verify and validate estimation simulation model .

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC602C	(OEC-II) Robotics	70	20	10	-	-	100	3	-	-	3

Module I
Introduction: Historical development of robots; basic terminology and structure; robots in automated manufacturing, robot configuration space and its topology, degrees of freedom

Module II
Rigid Motions and Homogeneous Transformation: Rotations and their composition; Exponential coordinates; Screw theory; Twists; Euler angles; homogeneous transformations

Module III
Forward Kinematics: Common robot configurations; Product of Exponentials formula; Denavit-Hartenberg convention
Velocity kinematics: Angular velocity and acceleration; The Jacobian
Inverse kinematics: Planar mechanisms; geometric approaches; pseudoinverse; spherical wrist; numerical approaches and Newton-Raphson method

Module IV
Statics of open chains: The use of the Jacobian; singular configurations; manipulability
Kinematics of closed-chains
Robot dynamics: Lagrangian dynamics; Euler-Newton equations for open kinematic chains. Forward and inverse dynamics.

Module V
Trajectory generation: trajectories in space of homogeneous transformations; minimum time trajectories
Feedback control: Actuators and sensors; velocity and torque control; PID control; linearization; feedback linearization
Vision-based control: The geometry of image formation; feature extraction; feature tracking (lab)

Text Books:

1. Lynch and Park, Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, 2017
2. Robotics, Vision, and Control, Peter Corke, Springer, 2011.
3. Introduction to Robotics, John J. Craig, Addison-Wesley Publishing, Inc., 1989.
4. Introduction to Robotics, P. J. McKerrow, ISBN: 0201182408

Course Outcomes:

CO1	Understand basic terminology ,structure of Robots and its topology
CO2	Analyze Rigid Motions and Homogeneous Transformation: Rotations and their composition;
CO3	Forward and Inverse kinematics of Common robot, numerical approaches and Newton-Raphson method
CO4	Apply Statics of open chain, manipulability Kinematics of closed-chains, Robot dynamics, Forward and inverse dynamics
CO5	Implement trajectory planning algorithm for straight line motion and executing PID based control , feedback control

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC603	Linear Control Theory	70	20	10	30	20	150	3	-	2	4

Module I

Basic Control System Introduction and Classification of control System, open and closed loop systems Linear Control System, Mathematical models of physical systems, Transfer function, Block Diagram Representation, Signal flow Graph, MIMO, Mason's gain formula, Linearization.

Module II

Error Analysis -Effects of Feedback on gain and time constant, pole location, bandwidth, Sensitivity, Disturbance signal, Control over System .Standard Test Signals, Time Response of 1st Order System, Design of Higher order system, Steady-State Errors and Error coefficients, error Constants, Effects of Additions of Poles and Zeros to Open Loop and Closed Loop System, Design Specification of Dynamic first and higher order system, Performance Indices.

Module III

Time Domain Stability Analysis- Concept of Stability of Linear Systems, Effects of Location of Poles on Stability, Necessary Conditions for Stability, Routh-Hurwitz Stability Criteria, Relative Stability Analysis, Root Locus technique, Experimental determination of transfer function.

Frequency Domain Stability Analysis- Performance Specification in Frequency Domain, Co-relation between frequency Domain and Time Domain, Bode Plot, Minimum-Phase and Non-Minimum Phase System, Polar Plots, Inverse Polar Plot, Nyquist Stability Criterion, Assessment of Relative Stability (Phase Margin, Gain Margin and Stability), Constant-M and N Circle, Nichols Chart.

Module IV

Approaches to System Design, Types of Compensation, Design of Phase-Lag, Phase Lead and Phase Lead-Lag Compensators in Time and Frequency Domain, Proportional, Derivative, Integral and PID Compensation. Modeling of discrete -time systems -sampling -mathematical derivations for sampling sample and hold -Z-transforms-properties -solution of difference equations using Z transforms -examples of sampled data systems -mapping between s plane and z plane

Module V

State variables Analysis and Design- Concept of State Variables and State Model, State Space Representation of Systems, Solution of State Equation, Transfer Function Decomposition, Discrete time system.

Text Books:

1. Ziemer R.E., Tranter W.H. &Fannin D.R., "Signals and Systems", Pearson Education Asia
2 Ogata K., "Modern Control Engineering", Prentice Hall India
3. Nagarath I.J. &Gopal M., "Control System Engineering", Wiley Eastern Ltd.
4.Kuo B.C., "Digital Control Systems", Oxford University Press

COURSE OUTCOMES

At the end of the course students will be able to:-

CO1: Describe mathematical model of the electrical and mechanical systems and simplify complex systems using different graphical techniques in closed and open loop systems.

CO 2: Apply time domain analysis and steady state response in control systems

CO 3: Analyze Time Domain and frequency domain stability Techniques in control systems

CO 4: Design control systems with the desired phase and gain performance.

CO 5: Demonstrate the concept of state, state variable and state model and apply this knowledge in steady state analysis automation systems.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC604	Digital Signal Processing	70	20	10	30	20	150	3	-	2	4

Module – I

Discrete-Time Signals and Systems : Review of Discrete-Time Sequences and Systems, Linear constant coefficient difference equations, Derivation of transfer function of LTI systems, Frequency Domain Representation of discrete time signals & systems, Signal flow Graph representation of digital network, matrix representation, introduction to Two dimensional sequences and systems.

Module - II

The z-Transform Applications: The review of Direct z-transform and Inverse- Z transform ,Mapping of S-domain to Z- domain, System Stability in Z-domain, Rational z-transforms, chirp – Z transform, Two dimensional Z-transform. Design of LTI systems using Z-transform.

Module - III

Frequency Analysis of Discrete Time Signals: Discrete Fourier series (DFS),Comparision of the DFS and Discrete 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, Decomposition for 'N' composite number.

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 ,finite word -length effects in digital filters.

Module - V

Digital filters Design Techniques: 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, Concept of Adaptive filtering and applications.

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.

DIGITAL SIGNAL PROCESSING LAB

(Suggested Exercise)

List of experiments:

The following practical should be performed using Matlab/ any DSP software –

1. Generation, analysis and plots of discrete-time signals.
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plots of z-transforms, verification of properties of z-transforms.
5. Computation and plot of DFT of sequences, verification of properties of DFT.
6. Computation and plots of linear/circular convolution of two sequences.
7. Computation of radix-2 FFT- Decimation in time and Decimation in frequency.
8. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
9. Design of windowing techniques of FIR Filter.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1.	Represent signal and system in various domain
CO2	Design of LTI system using Z Transform
CO3	Analyze the frequency if Discrete Time Signal
CO4	Classify various Filter structures
CO5	Designing of various Digital Filters

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz / Assignment	End Sem	Lab Work					
EC605	Microwave & Radar Engg.	70	20	10	30	20	150	3	-	2	4

MODULE I

Microwave Components: Rectangular cavity resonators; Q of a cavity resonator; Re-entrant cavities; Slow-wave structure; Microwave hybrid circuits; S-parameters and their properties; Waveguide tees; Hybrid ring; Waveguide corners bends and twists; Two hole directional coupler; S-Matrix; Circulators and Isolators; Hybrid couplers.

MODULE – II

Microwave Linear Beam and Crossed-Field Tubes: Failure of conventional tube at high frequency; Klystron-Velocity modulation; Bunching; output power and loading; Reflex klystron-Velocity modulation; power output and efficiency and electronic admittance; Helix travelling wave tubes; amplification\process; Conventional current; Electric field wave modes; Basic principle of coupled cavity; Magnetron-Types and Principles of operation; Modes of oscillation; Strapping; pi-mode separation.

MODULE – III

Microwave Devices: Transistors, Tunnel Diodes and Microwave FETs: Structure; Operation; Characteristics and Power frequency limitations of microwave transistors; Tunnel diodes and Field-Effect Transistors. Transfer Electron Devices: Gunn diode; Gunn Effect; Principle and Mode of operation; Microwave generation and amplification Tunnel Diode; PIN diode and Crystal diode. Modulator; Switches, Avalanche Transit- Time Devices: Physical Structure; Principle of operation; Characteristics; Power output and Efficiency of IMPATT, TRAPATT and BARITT diodes; Parametric amplifiers.

MODULE – IV

Microwave Design Principles. Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design. Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Measurement: Microwave bench; Precautions; Power measurement; Bolometric method; Attenuation; VSWR; Impedance, Frequency and Q of the Cavity.

MODULE – V

Principles and Applications of Radar: Basic Radar, Radar Block Diagram, Radar Frequencies, Applications of Radar, Radar Range Equation, MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, delay line cancellers, staggered PRF. Range gated Doppler filter, limitations to MTI performance. Tracking with Radar, Monopulse Tracking, Conical Scan and Sequential Lobing, Limitations to Tracking Accuracy, Low Angle Tracking, Tracking in range, Comparison of Trackers.

Text Books:

1. Microwave Devices and Circuits by Samuel Y. Liao, 3rd Ed., Pearson Education.
2. Foundations of Microwave Engineering by R .E. Collin, TMH Pub.
3. Introduction to Radar Systems by M.I Skolnik, TMH Pub. Co.

Reference Books:

1. Microwave Principles by Reich.
2. Microwaves, Gupta, New Age International Publishers.
3. Microwave and Radar Engg., M. Kulkarni, Umesh Publication.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Apply concepts of electromagnetic theory to calculate parameters of waveguides and transmission lines.
CO2	Design and analyze microwave components and tubes.
CO3	Design and analyze passive and active microwave devices.
CO4	Analyze the designing of microwave filter, microwave amplifier, microwave mixer and microwave oscillator.
CO5	Analyze the principle of radar.

Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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	EE601	PEC	Professional Elective - I	70	20	10	-	-	100	3	1	-	4
2	EE602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	EE603	PCC	Microprocessor & Microcontroller	70	20	10	30	20	150	3	-	2	4
4	EE604	PCC	Switchgear & Protection	70	20	10	30	20	150	3	-	2	4
5	EE605	PCC	Power System Analysis	70	20	10	30	20	150	3	-	2	4
6	EE606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	EE607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	EE608	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 EE608 for the award of Honours (Minor Specialization).									

Note: 1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I

S.No.	Subject Code	Subject Name
1	EE601A	Computer Aided Design of Electrical Machines
2	EE601B	Wind & Solar Energy Systems
3	EE601C	Control System Design

List of Open Elective Course - II

S.No.	Subject Code	Subject Name
1	EE602A	Signal & System
2	EE602B	Power Plant Engineering
3	EE602C	Electrical & Hybrid Vehicles

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

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. (Electrical Engineering) Semester: VI

EE 601 C Professional Elective – I)

(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					
EE 601 A	Computer Aided Design of Electrical Machines	70	20	10	-	-	100	3	1	-	4

Module I : GENERAL CONCEPT OF COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES: Introduction to CAD and CAM, Details of Flowcharts for design of electrical machines, objective Parameters for Optimization in an Electrical Machine. Selection of Optimal Design, Lowest Cost and Significance of "Kg/KVA", Relation between rating and dimensions of rotating machines, Main dimensions, Total loading, Specific loadings ,Output coefficient . Factors affecting size of Rotating machines, Choice of specific magnetic loading, choice of specific electric loading , Heating cooling and ventilation in electrical machines, types of enclosures, General Design Procedure, steps for optimal design.

Module II : TRANSFORMERS: Design of Core and shell type transformers, Sequential Steps for Design of Each Part & Programming Simultaneously, Design of Magnetic Frame, No-Load Current, Design of LV and HV Windings, Performance Calculations, Tank Design & Weights, Computer Program and output results for Optimal Design

Module III : INDUCTION MOTORS: Design of Squirrel Cage Motor, Sequential Steps for Design of Each Part and Programming Simultaneously , Calculation of Stator Main Dimensions & Flux, Design of Stator Winding, Design of Squirrel Cage Rotor, Total AT & Magnetizing Current, Short-Circuit Current and performance Calculation, Design of Slip-Ring Type Induction Motor, Computer Program for Complete Design, Computer Program and output results for Optimal Design .

Design of single phase induction motor, Sequential Steps for Design of Each Part and Programming Simultaneously Calculation of Main Dimensions, Design of Main Winding, Design of Rotor, AT and leakage reactance calculations, Design of Auxiliary Winding, Weights, Losses and Performance using Eq.Ckt, Computer Program for Complete Design, Computer Program and output results for Optimal Design .

Module IV: SYNCHRONOUS MACHINES: Design of salient pole and cylindrical rotor Machines -Sequential Steps for Design of Each Part and Programming Simultaneously, Calculation of the Stator Main Dimensions & Flux/Pole, Design of Armature Winding & Core, Design of Rotor & Calculation of AT, Carter Coefficients, OCC, Field Current at Rated Load & PF, Field Winding Design Losses and Efficiency, Calculation of Temperature Rises & Weights, Computer Program and output results for Optimal Design .

Module V : DC MACHINES Sequential Steps for Design of Each Part & Programming Simultaneously, Calculation of Armature main Dimensions and flux for pole, Design of Armature Winding & Core, Design of Poles & Calculation of AT, Design of Shunt Field & Series Field Windings, Design of Commutator & Brushes, Design of Inter-Pole/Compensating-Winding and Overall Performance, Computer Program for Complete Design, Computer Program and output results for Optimal Design .

References:

1. K M Vishnu Murthy,- "Computer Aided Design of Electrical Machines", BS Publication Hyderabad

2. K. Hameyer & R. Belmans -Numerical Modelling and Design of Electrical Machines and Devices WIT Press

3. Veinott, Cyril G.- "Computer-Aided Design of Electric Machinery" MIT Press

4. V.K. Maurya, Jalan , Shukla - "Computer Aided Design of Electrical Machines", Kataria Pub, New Delhi.

Course Code : EE601
Course Category : PEC
Course Name : Computer Aided Design of Electrical Machines

After completion of this course students will be able to-

CO1: Understand the fundamental design concepts of rotating electrical machines.
CO2: Conventional design of electrical machines.
CO3: Develop designs dimension of electrical machines using computer based techniques.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

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

(w.e.f. July 2019)

EE 601 (Professional 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					
EE601C	Control System Design	70	20	10	-	-	100	3	1	-	4

Module I: Design of Feedback Control Systems : Introduction; Approaches to System Design; Cascade Compensation Networks; Phase-Lead Design Using the Bode Diagram; Phase-Lead Design Using the Root Locus; System Design Using Integration Networks; Phase-Lag Design Using the Root Locus; Phase-Lag , phase lead Design Using the Bode Diagram; Design on the Bode Diagram Using Analytical Methods; Systems with a Pre-filter; Design for Deadbeat Response; Design Examples.

Module II: Design of State Variable Feedback Systems : Introduction, State space representation of physical systems, State space models of some common systems like R-L-C networks, DC motor, inverted pendulum etc., Controllable Canonical Form, Observable Canonical Form, Diagonal Canonical Form, State transitionmatrix, Solution of state equations, Controllability and Observability, Full-State Feedback Control Design; Observer Design; Integrated Full-State Feedback and Observer; Tracking Reference Inputs; Internal Model Design; Design Examples.

Module III: Introduction to Robust Control and Optimal Control : Robust control system and system sensitivities to parameter perturbations, analysis of robustness, systems with uncertain parameters, considerations in design of robust control system, robust PID controller.

Module IV: Lyapunov's Stability and Optimal Control : Positive/negative definite, positive/negative semi-definite functions, Lyapunav stability criteria, introduction to optimal control, Riccatti Equation, Linear Quadratic Regulator, Design Examples.

Reference Books:

1. ModernControl Engineering by K. Ogata, PHI.
2. Discrete Time Control Systems by K. Ogata, PHI.
3. Automatic Control Systems by B C Kuo, PHI.
4. Control Systems, Principles and Design by M. Gopal, MC Graw Hill, 2012

Course Outcome: **(EE601C) Control System Design**

After learning the course the students should be able to:

CO1. Define fundamental control system design specifications and basic principles of controller design.

CO2. Recognize the importance of observability and controllability for system design.

CO3. Design modern controllers based on the state space techniques, optimal control and robust control techniques.

CO4. Design cascade compensators based on time Domain and frequency domain analysis techniques; synthesize the controller using analog circuits.

CO5. Design state feedback and optimal control.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. [AICTE] (Electrical Engineering) Semester: VI

(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					
EE602 A	Signal & System	70	20	10	-	-	100	3	-	-	3

Module-I

Dynamic Representation of Systems: systems Attributes, Causality linearity, time-invariance. Special Signals, Complex exponentials, Singularity functions (impulse and step functions)..Linear Time-Invariant Systems: Differential equation representation convolution integral. Discrete form of special functions. Discrete Convolution and its properties. Realization of LTI system (differential and difference equations).

Module-II

Fourier Analysis of Continuous Time Signals and Systems: Fourier Series, Fourier Transform and properties, Parseval's theorem, Frequency response of LTI systems. Sampling Theorem, reconstruction of Signal from its samples, sampling in the frequency domain.

Module-III

Fourier Analysis of Discrete Time Signals & Systems: Discrete-Time Fourier Series, Discrete-Time Fourier Transform (including DFT) and properties, Frequency response of discrete time LTI systems.

Module-IV

Laplace Transform: Laplace Transform and its inverse: Definition, existence conditions, Region of Convergence and properties, Application of Laplace transform for the analysis of continuous time LTI system (stability etc.) Significance of poles & zeros.

Z-Transform: Z-Transform and its inverse: Definition, existence, Region of convergence and properties, Application of Z-Transform for the analysis of discrete time LTI systems, Significance of poles and zeros, sampling of discrete-time signals.

Module-V

Introduction to Digital Signal Processing.

References

1. Alan V. Oppenheim, Alan S. Willsky and H. Nawab, Signals and systems, Prentice Hall, 1997
2. Simon Haykin, "Signals & Systems", 3rd Edition, John Wiley, 1995
3. Proakis, Manolakis & D. Sharma, "Digital Signals Processing", Pearson Pub.

Course Code : **EE602**
Course Category : **OEC**
Course Name : **Signals & Systems**

After completion of this course students will be able to-

CO1: Classify different signals and systems.
CO2: Determine Fourier analysis of continuous and discrete time signals.
CO3: Apply Laplace transform and Z transform for the analysis of continuous and discrete time LTI systems.
CO4: Explain the basics of digital signal processing.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech [AICTE] (Electrical Engineering) Semester: VI

(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					
EE 603	Micro-processor & Micro-controller	70	20	10	30	20	150	3	-	2	4

Module I

Microprocessor 8086: Introduction to 16-bit 8086 microprocessors, architecture of 8086, pin configuration, interrupts, minimum mode and maximum mode, tinning diagram, Memory interfacing, Comparative study of Salient features of 8086, 80286 and 80386.

Module II

Microprocessor 8086 Programming: Introduction set of 8086, Addressing mode, assembler directives & operations, assembly and machine language programming, subroutine call and returns, Concept of stack, Stack structure of 8086, timings and delays,

Module III

Input-Output interfacing: Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 8254, QSART 8251, 8 bit ADC/DAC interfacing and programming.

Module IV

Microcontroller 8051 : Intel family of 8 bit microcontrollers, Architecture of 8051. I/O Configuration, interrupts, Interrupt structure and interrupt priorities, port structure and operation, Accessing internal & external memories and different mode of operation, Memory organization, Addressing mode, instruction set of 8051 and programming.

Module V

8051 Interfacing. Applications and serial communication: 8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/counter function, 8051 based thyristor firing circuit, 8051 connections to Rs-232, 8051 Serial communication, Serial communication modes, Serial communication programming, Serial port programming in C.

BOOKS:

1. Hall Douglas V. Microprocessor and interfacing, Programming and Hardware, second edition, Macmillan McGraw Hill.
2. Ray A.K. Burchandi K.M. Advance Microprocessor and peripheral, first edition, TMH
3. Kenneth J. Ayala, The 8086 microprocessor. Programming and interfacing the PC, Indian edition CENGAGE Learning.
4. Muhammad Ali Mazidi and Janice Gillespie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson education, 2005

5. Kenneth J. Ayala,The 8051 Microcontroller Architecture, III edition, CENGAGE Learning.
6. V. Udayashankara and M.S. Mallikarjunaswany , 8051 Microcontróller, McGraw Hill.
7. McKinley, The 8051 Microcontroller and Embedded Systems-using assembly and C,PHI, 2006/Pearson, 2006.

List of Experiments :

1. Assembly Language Programs Microprocessor 8086
2. Assembly Language Programs of Microcontroller 8051
3. Assembly Language Programs of Interfacing chips

Course Code : **EE603**
Course Category : **PCC**
Course Name : **Microprocessor & Microcontroller**

After completion of this course students will be able to-

CO1: Understand the working of processor and develop 8086 assembly level programs.
CO2: Apply 8051 to interface peripheral and IOs in interrupt driven data transfer mode.
CO3: Interface various peripheral ICs like 8255, 8257, 8251, and 8254 with 8086 Microprocessor.

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(AICTE Model Curriculum based scheme)

B.Tech. [AICTE] (Electrical Engineering) Semester: VI

(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					
EE604	Switchgear & Protection	70	20	10	30	20	150	3	-	2	4

Module-I : **Relays** : General consideration, sensing of fault, primary and back up protection, basic requirements of protective relaying, classification of relays, construction of electromagnetic relays, induction type relay principle, inverse time and definite time characteristics, over current, over voltage, directional, distance relays, differential buchholz and negative phase sequence relays.

Module -II : **Advance relays** : Static Relays : Classification of static relays, block diagram & components of static relays, comparators, static over current, static directional, static distance and static differential relays. Microprocessor Based Relays: General considerations, flow chart and software development for protection, microprocessor based over current relay, directional relay, distance relay, security and reliability. Numerical Relays: Principle, characteristics and operation of numerical relay. FPGA based relays.

Module-III : **Protection** : Types and detection of faults and their effects, alternator protection scheme, power transformer protection, generation-transformer unit protection scheme, busbar protection, transmission line protection, frame leakage protection, pilot relay scheme.

Module -IV : **Switchgear** : Fuse : Characteristics, types of fuses, selection of fuses, construction and application of HRC fuses. Circuit breaker : basic principle of operation, are phenomenon, initiation and maintenance of are, arc interruption methods, are voltage and current waveform in AC circuit break in, re-striking and recovery voltage, current chopping, rating of circuit breakers, breaking capacity, making capacity, short time rating, working principle and important features of oil CB, minimum oil CB, air blast CB, Vacuum CB and SF6CB, auto high speed re-closing.

Module -V : **Over voltage protection and neutral grounding** : Surge over voltages : Causes of over voltages, lightning phenomenon, protection of transmission line against over voltages, klydonograph and magnetic link, switching surges, surge diverters petersion coil and insulation coordination.

Neutral grounding : Resistance earthing, reactance earthing, resonance earthing, voltage transformer earthing, earthing transformer.

References:

1. Sunil S.Rao, Switchgear and Protection, Khanna Pub New Delhi, 1986
2. C.L. Wadhwa, Electrical Power Systems, Newage International (P) Ltd 2000
3. B.Ravindranath and N. Chander Power System Protection & Switchgear, wiley Erstern Ltd 1977
4. Badri Ram, Vishwakarma, Power System Protection and Switchgear, Tata Mc Graw Hill 2001
5. T.S.Madhava Rao, "Power System Protection: Static Relays with Microprocessor Application", Second edition. McGraw Hill Pub.
6. S.R.Bhinde. "Digital Power System Protection", pHI Pub.

LIST OF EXPERIMENTS :

1. To plot operating characteristics by performing operation of inverse definite minimum time (IDMT) relay.
2. To check the percentage setting of percentage differential relay by performing operation.
3. To find the pick-up value and reset-value of instantaneous relay by performing operation.
4. To perform operation and plot the directional characteristics of directional over current relay on R-X diagram.
5. To perform operation and plot the characteristics of over/under voltage microcontroller based relay.
6. To check the operation of microcontroller based over current relay and plot the curves.
7. To plot the directional characteristics of microprocessor based directional relay by performing operation.
8. To perform operation and plot characteristics of microprocessor based differential relay.

Course Code : **EE604**
Course Category : **PCC**
Course Name : **Switchgear & Protection**

After completion of this course students will be able to-

CO1: Categorize various types of relay's and their working
CO2: Explain the types, working and application of circuit breakers..
CO3: Illustrate Protection of Bus-bar, transmission line, transformers and alternator.
CO4: Develop and design of various protection schemes.

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(AICTE Model Curriculum based scheme)

B.Tech. [AICTE] (Electrical Engineering) Semester: VI

(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					
EE 605	Power System Analysis	70	20	10	30	20	150	3	-	2	4

Module -I Power System Network Matrices

Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} formation by Direct and Singular Transformation Methods, Numerical Problems. Formation of Z_{Bus}: Partial network, Algorithm for the Modification of Z_{Bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old buses (Derivations and Numerical Problems).- Modification of Z_{Bus} for the changes in network (Problems)

Module –II Power flow Studies-1

Necessity of Power Flow Studies, Data for Power Flow Studies, Derivation of Static load flow equations, Load flow solutions using Gauss Seidel Method: Acceleration Factor, Load flow solution with and without P-V buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

Module – III Power flow Studies-2

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC load Flow

Module –IV Power System Steady State Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

Module –V Power System Transient State Stability Analysis

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of equal Area Criterion, Critical Clearing Angle Calculation.- Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability – Application of Auto Reclosing and Fast Operating Circuit Breakers.

REFERENCE BOOKS:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis by Hadi Saadat – TMH Edition.
4. Power System Analysis by B.R.Gupta, Wheeler Publications.
5. Computer Techniques in Power System Analysis by M.A.Pai, TMH Publications.
6. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing company, 2nd edition.

Course Code : **EE605**
Course Category : **PCC**
Course Name : **Power System Analysis**
After completion of this course students will be able to-

CO1: Use power flow methods in the power-flow problem (hand calculation and simulation)
CO2: Calculate power system admittance and impedance matrices.
CO3: Analyze and determine Power System steady state and transient stability.

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

B.Tech. [AICTE] (Electrical Engineering) Semester: VI

(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					
EE 606	Minor Project I	-	-	-	60	40	100	-	-	2	1

Study regarding field data/Laboratory investigating Analysis /Design of the subject related to Electrical Engineering.

JABALPUR ENGINEERING COLLEGE, JABALPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

(AICTE Model Curriculum based Scheme)

Bachelor of technology, Semester – 6th

Professional Elective - 1

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					
EE-601B	Wind & Solar Energy Systems	70	20	10	-	-	100	3	1	-	4

Wind & Solar Energy Systems

Module - 1: Introduction to Wind Energy:

Basic Introduction of renewable energy, Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm Development of Wind Power Generation,

Module - 2: Wind Energy Systems:

Wind Power Conversion, Power Equation for wind turbine, Power converter for Wind Turbines, Control and Grid requirement for Modern Wind Turbines, Types of Wind Generators, Singly Excited Induction Generator (SEIG), Standalone operation of fixed and variable speed energy conversion systems, Capacitance Requirement, Doubly Fed Induction Generator: Principle, Operation and their analysis, Vector Control of DFIG using an AC-DCAC converter, DFIG based Wind Energy Conversion Systems

Module - 3: Introduction to Solar Energy:

Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation, radiation on tilted surface

Module - 4: Solar Energy Systems:

solar energy conversion into heat, types of solar collectors, evacuated and non-evacuated solar air heater, concentrated collectors, thermal analysis of liquid flat plate collector, air heater and cylindrical parabolic collector, solar energy thermal storage, heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air conditioning, solar pond, heliostat, solar furnace photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages

Module - 5: Economic Analysis:

Initial and annual cost, basic definitions, present worth calculations, repayment of loan in equal annual installments, annual savings, cumulative saving and life cycle cost, economic analysis of add on solar system, payback period, and clean development mechanism

Course Outcomes:

After the completion of the course, the students will be able to:

- Explain constant wind power plant.
- Compare different variable speed wind power plant.
- Design Different Solar based Applications.
- Carry out preliminary economic analysis of RE systems.

Reference Books:

- Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGrawHill Education.
- Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York.
- Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York.
- Wind Power Technology Earnest, Joshua PHI Learning, New Delhi, 2013
- Generation and Utilization of Electrical Energy S. Sivanagaraju Pearson, New Delhi, 2011.

Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	IP601	PEC	Professional Elective - I	70	20	10	-	-	100	3	1	-	4
2	IP602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	IP603	PCC	Operations Research	70	20	10	30	20	150	3	-	2	4
4	IP604	PCC	Manufacturing Technology	70	20	10	30	20	150	3	-	2	4
5	IP605	PCC	Turbo Machines	70	20	10	30	20	150	3	-	2	4
6	IP606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	IP607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	IP608	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 ME608 for the award of Honours (Minor Specialization).									

Note: 1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I

S.No.	Subject Code	Subject Name
1	IP601A	Operations Management
2	IP601B	Strategic Management
3	IP601C	Quality Engineering

List of Open Elective Course - II

S.No.	Subject Code	Subject Name
1	IP602A	Applied Thermodynamics
2	IP602B	IPR
3	IP602C	Product Design & Development

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

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

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

Credits: 4	IP-601A	Operations Management	L: 3, T: 1,P:0

Course Objective:

- To be familiar with Scope and Significance of Operations Management.
- To provide the knowledge to select plant location and Design of various plant layout .
- To provide the knowledge about product design and development
- To be familiar with methods of forecasting.
- To explain production planning and economic analysis.

Course content:

OPERATIONS MANAGEMENT
IP-601A

Module 1.

Operations Management : Overview, Definition, Scope and Significance, Systems View of Operations Management, Factors of Production, Resource productivity, Productivity.

Plant Location: Issues in plant location, Plant Location Methods, Factor – Rating Systems, Transportation
method, Centroid Method, Break Even Analysis, Plant Layout objectives, Types of layouts: Process layout, Systematic Layout Planning, Computerized Layout Techniques, Product Layout: Assembly line balancing, Cellular Layout, Fixed Position Layout..

Module 2

Product Design and Development : Stages in Product development, Product life cycle, Product Development Process: Generic process and its Variants, Designing for the Customer: Quality Function Deployment, House of Quality, Product analysis, Standardization, Simplification, diversification and Modular design, Measurement of Product Development Performance, Concurrent Engineering.

Module 3

Forecasting : Need of forecasting, Costs of Forecasting, Methods of Forecasting, Delphi technique, Nominal Group Technique, Simple moving average, Weighted moving average, Exponential Smoothing, Linear Regression method, Forecasting error its sources and measurement.

Operation Scheduling and Control: Functions of Scheduling and Control, Production Scheduling, Machine Loading, Sequencing, Dispatching, Expediting.

Module 4

Production Planning: Introduction to Aggregate Production Planning and Master Scheduling, Materials Requirement Planning (MRP), MRP Structure and Output, Applications.Manufacturing Resource Planning (MRP II), Just-In-Time production System, Waste and waste elimination, Kanban System and Conwip shop floor control, Kaizan.

Module 5

Economic Analysis: Capital budgeting, meaning and significance, types of capital expenditure, analysis, interest and present value concept, depreciation, Capital investment evaluation techniques - pay back period, Rate of return on investment, Net Present value method, Internal rate of return method.

Reference Books :

6. Elements of Production Planning & Control by Eilon McMillan
7. Production and Operations Management by R.Mayer, McGraw Hill
8. Production and Operations Management by Buffa, McGraw Hill]
9. Product Design and Process Engineering By Niebel and Draper, McGraw Hill
10. Operations Management, Schaum's Outlines, TMH
11. Operations Management by Richard B. Chase, McGraw Hill
12. Production and Operations Management by Adam & Ebert, PHI.

Course Outcomes:

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

CO1	Understand Significance of Operations Management.
CO2	Optimize Plant Layout and factors affecting it
CO3	Analyze Stages in Product development and Product life cycle
CO4	To apply methods of forecasting such as Delphi technique, Nominal Group Technique,
CO5	To do production planning and economic 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	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	1

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

Credits: 3	IP-602A	Applied thermodynamics	L: 3, T: 0 ,P:0

Course Objective:

- To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment.
- To understand the principles of refrigeration and air conditioning.
- To calculate the cooling load for different applications.
- To design and implement refrigeration and air conditioning systems using standards

Course Content:

APPLIED THERMODYNAMICS
IP-602 A

Module I:

Conduction: Basic concepts ,Conduction, Convection and Radition,Electrical Analogy, Fourier's law of conduction, Conduction of heat transfer through slabs, hollow cylinder, Sphere,Composite systems, Critical radius of insulation for Pipes/cables.

Convection: Natural & forced convection.Simple problems on correlations based on horizontal Pipe and Plate .

Module II:

Heat exchangers: Logarithmic Mean Temperature difference for Parallel and Counter flow Heat Exchanger.LMTD correction factor & Fouling factor, Effectiveness of Heat Exchanger. Simple problems based on LMTD method.

Module III:

Radiation: Basic introduction to radiation heat transfer.Black body laws, Emissivity, solid angle, Intesity of Radiation, Shap factor, Heat transfer by radiation for simple configurations.

Refrigeration: Methods of refrigeration, unit of refrigeration and COP, Carnot refrigeration cycle, Air refrigeration cycle, Bell Coleman air refrigeration cycle, Introduction to air craft refrigeration system. Simple and Boot strap air craft refrigeration system , Simple problems on air refrigeration cycle.

Module IV:

Refrigerants: Classification, Nomenclature, Desirable properties of Refrigerants, Comparative study of Refrigerant,Leak detection, Future Refrigerants.

Simple vapour compression refrigeration cycle: P-H, T-S and H-S diagrams for vapour compression refrigeration system, Analysis of simple saturated cycle, Effect of Condensor and Eveporator pressure,Subcooling and Super heating. Simple problems.

Module V:

Air Conditioning: Psychometric properties & relations. Psychometric chart, Psychometric processes, Sensible heat factor,Bypass factor,Infiltrated air and Ventilation.Requirement of comfort air conditioning ,Simple problems based on Psychrometry, Psychrometric processes and cooling load calculations

IND & PRODUCTION
Engg. Department
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References:

1. Heat transfer - J.P. Holmon
2. Engineering Heat transfer - Gupta & Prakash
3. Fundamental of Engineering Heat and Mass transfer- P.K.Nag
6. Refrigeration & air conditioning - Stoecker & Jones
7. Refrigeration & air conditioning - C.P. Arora

Course Outcomes:

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

CO1	Ability to understand and solve conduction convection and radiation problems.
CO2	Ability to analyze the performance of heat exchangers.
CO3	Illustrate the basic concepts of refrigeration system.
CO4	Analyze the vapour compression cycle and interpret the usage of refrigerants.
CO5	Explain the components of vapour compression system.

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

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

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

Credits: 4	IP-603	Operations Research	L: 3,	P: 2

Course Objective:

- Identification and developing operational research models from the verbal description of the real system.
- Explain the mathematical tools that are needed to solve optimisation problems.
- Provide knowledge of mathematical software to solve the proposed models.
- Analyze the results To learn about Linear Programming.
- Explain network analysis, Game theory

Course Content:

OPERATIONS RESEARCH
(IP-603)

Module 1

Linear Programming: Introduction, History and development of Operations Research, Model building, Linear programming-formulation, Graphical method, Conical and standard forms of linear programming problems, Theory of simplex method, Big-M method, Two-phase method, Degeneracy in linear programming problems, Revised simplex, Sensitivity analysis.

Module II

Allocations in Linear Programming Problem: Assignment model-Hungarian method, Travelling salesman and miscellaneous problem, Assumptions in Transportation model, Optimality test, Degeneracy in Transportation Problem, Unbalanced Transportation Problem and Transshipment Problem.

Module III

Decision and Game theory: Decision tree, Decision making models under certainty, Risk and uncertainty, Hurwicz criteria, Game theory, two persons zero sum games, maximin and minimax principles, Saddle point, Dominance rule, Graphical and algebraic methods of solution.

Module IV

Dynamic Programming: Characteristics of dynamic Programming, Bellman principal, Typical problems, Salesmen problem, Forward and backward recursion, Use of software to solve linear programming and Dynamic programming.

Module V

Queuing Theory Network Analysis: Characteristics of queuing system, Poisson formula, birth-death system, equilibrium of queuing system, Analysis of M/M/1 queues, Project Planning, Project scheduling, Project controlling, Basic tools and technique of project management, AOA and AON diagrams, Critical path method, Program evaluation and review technique.

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References:

1. Taha. H.A. Operations Research, PHI, Publications.
2. Hiller and Liberman Introduction to Operations Research, TMH Publications.
3. Sharma.J.K. Operations Research Theory and Applications, Macmillan Publications.
4. Ramamurthy.P. Operations Research, New Age Publications.
5. Banerjee.B. Operations Research, Business Publicity, Bombay.
6. Hira and Gupta. Operations Research, S. Chand Publication.

OPERATIONS RESEARCH LAB
(IP-603)

LIST OF EXPERIMENTS :

3. To Solve L.P.P. (Maximization Problem) by graphical method Using Operations Research software.
4. To Solve L.P.P. (Minimization Problem) by graphical method Using Operations Research software.
5. To Solve L.P.P. (Maximization Problem) by simplex method Using Operations Research software.
6. To Solve L.P.P. (Minimization Problem) by simplex method Using Operations Research software.
7. To find Initial basic feasible Solution of the given Transportation Problem.
8. To find Initial Optimal Solution of the given Transportation Problem.
9. To find optimal Solution of the given Assignment Problem.
8. To find optimal solution of two person zero sum game.

Course Outcomes:

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

CO1	Understand methodology of Operations Research.
CO2	Analyze the results to learn about Linear Programming.
CO3	Solve optimization problems
CO4	Develop a report that describes the model and the solving technique.
CO5	To carry out network 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	2	1	1	1	1	0	0	1	1	1	1
CO2	1	3	1	0	3	1	0	1	0	1	1	0
CO3	1	3	3	1	3	0	1	0	0	1	1	1
CO4	1	1	1	0	1	0	0	0	0	1	1	1
CO5	1	2	1	1	2	0	0	0	0	1	1	1

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Engg. Department
J.E.C., Jabalpur

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

Credits: 4	IP-604	Manufacturing technology	L: 3,	P: 2

Course Objective:
To learn about working procedure of arc welding, gas welding, special welding process,soldering,brazing ,surface finishing process, press working , their process parameters and working principle.

Course content:

MANUFACTURING TECHNOLOGY
(IP-604)

Module I : Arc welding: Arcing phenomenon, Metal transfer in arc welding, Arc blow, Types of electrodes, Carbon Arc Welding, Flux Shielded Metal Arc Welding, Submerged Arc Welding, TIG Welding, MIG Welding, Plasma Arc Welding, Arc Welding equipments.
Gas welding: Oxy Acetylene Welding, Welding flames, Leftward and Rightward welding, filler metals and rods, Gas Welding equipments, Oxy Hydrogen and other Fuel gas welding, Air acetylene welding. Pressure welding; Spot, Seam and Butt welding, Thermo Chemical welding.

Module II : Resistance welding:
Electric resistance welding, Variables in resistance welding, Spot welding: procedure, spot welding methods, Heat balance in spot welding, Spot welding equipment, Seam welding: Seam welding equipments, Principle of operation, Applications, Projection welding, Resistance butt welding, Flash butt welding, Percussion welding.
Special welding process: Cold pressure welding; Diffusion welding, Ultra sonic welding, Explosive welding, Friction welding and Inertia welding, Forge welding, Electron beam welding, laser beam welding, Atomic hydrogen welding, Thermit welding, Under water welding process, Thermal spraying & Metal-addition.

Module III : Soldering & Brazing: Soldering: Definition. Principles of soldering process, Soldering alloys, Soldering fluxes, Soldering methods.
Brazing: Principle of operation, Brazing procedure, Brazing fluxes, Constituents of fluxes, Brazing processes, limitations in brazing.
Surface finishing process: Super finishing, Lapping, Honing, Tumbling, Electroplating, Metal spraying.

Module IV : Press working: Press operations, Classification of Presses, Press working terminology, Types of
dies, drawing dies, Bending dies, Punch design, Pilots, Types of pilots, Shearing operations: Piercing, Blanking, Notching, Drawing, Spinning, Bending, Stretch Forming, Embossing and Coining.
Powder Metallurgy: Process, Method of production of powder, Metal powder characteristics, Application of powder metallurgy.

Module V : Distortion & discontinuities in weld-jobs: Weld-jobs distortion and its control, various discontinuities in welds, Residual stresses in weld-jobs residual stresses-distortion-relieving of stresses. **Automation in welding**: Structure analysis; Basic operations, Robotic welding, Types of welding robots.

Non Destructive Testing and inspection of weld-jobs: Non destructive methods of testing weld-jobs; stages of weld inspection and testing, visual inspection ,leak test; stethoscopes test; X-ray and γ-ray radiography, magnetic particle inspection; liquid(dye) penetrate test; fluorescent penetrate inspection; ultrasonic inspection and Eddy current testing.

References

1. Malhotrà; Handbook on Non-destructive Testing of Concrete; CRC Press,
2. Henrique L M; Non Destructive Testing and Evaluation for Mfg, Hemisphere Pub NY,
3. Rao PN; Manufacturing Technology Vol 1; TMH
4. Groover MP; Fundamentals of Modern mfg; Wiley India
5. Kaushish JP; Manufacturing Processes; PHI Learning
6. Oswald PF; Mfg Processes and Systems; Wiley India
7. Parmar, R.S; Welding Processes and Technology
8. Srinivasan.N.K.; Welding Technology; Khanna Pub.

Course Outcomes:

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

CO1	Understand Principles and working procedure of arc welding and gas welding.
CO2	Understand soldering,brazing ,surface finishing process.
CO3	Find out Distortion & discontinuities in weld-jobs.
CO4	Perform non destructive testing and inspection of weld jobs.
CO5	Understand Application of powder metallurgy.

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	0	1	1	0	0	1	0	1	0
CO2	2	2	1	0	2	1	0	1	0	1	0	0
CO3	1	3	1	2	2	0	1	0	0	0	0	1
CO4	1	2	1	1	2	0	0	0	0	0	0	0
CO5	1	0	1	0	1	0	0	0	0	0	0	1

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

Credits: 4	IP-605	Turbo Machines	L: 3, P:2

Course Objective:

The course aims at giving an overview of different types of turbo machinery used for energy transformation, such as pumps, compressors, as well as hydraulic, steam and gas-turbines.

Course content :

TURBO MACHINES
(IP-605)

Module 1

Basics of turbo machines, Principles of impulse and reaction machines.

Steam turbines: Impulse staging, Velocity and Pressure Compounding, Utilization factor, Analysis for optimum U.F Curtis stage, and Rateau stage, includes qualitative analysis, Effect of Blade and Nozzle losses on Vane Efficiency, Stage efficiency, Analysis for Optimum Efficiency, Mass Flow and Blade Height.

Module 2

Reactions staging: Parson's stages, Degree of reaction, Nozzle Efficiency, Velocity Coefficient, Stage Efficiency, Carry over efficiency, Vane Efficiency, Conditions for Optimum Efficiency, Speed Ratio, Axial thrust, Reheat Factor in Turbines, Governing and Performance Characteristics of Steam Turbines.

Module 3

Water turbines: Classification, Pelton, Francis and Kaplan turbines, Vector diagrams and Work-done, Draft tubes, Governing of Water Turbines.

Centrifugal Pumps: Classification, Advantage over Reciprocating Type, Definition of Mano-metric head, Gross head, Static head, Vector diagram and work done.

Module 4

Rotary Compressors: (a) **Centrifugal Compressors** – 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, Temperature Dimensional Analysis, Characteristics, Surging, Polytrophic and Isentropic Efficiencies.

Module 5

Gas Turbines: Introduction, Classification, Application. Gas turbine & its components. Closed and open cycle Gas turbines, Optimum Pressure ratio for maximum specific & thermal efficiency in actual Gas Turbine Cycle. Effect of operating variables on thermal efficiency.

References:
3. Venkanna B. K.; Turbomachinery; PHI
4. Hill G Philip and Peterson RC; Mechanics and thermodynamics of propulsion; Pearson.
5. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Newage Delhi
6. Ganeshan V; Gas Tuirbines; TMH
7. Yahya SM; Turbines, Compressors and Fans; TMH
8. Shepherd DG; Principles of Turbo machinery; McMillan
9. Bansal R. K; Fluid Mechanics & Fluid Machines; Laxmi Pub
10. Sarvanmulto HIH, Rogers GFC &; Cohen Henry Gas Turbine Theory; Pearson

TURBO MACHINE LAB
(IP-605)

List of Experiments

7. To study various parameters of steam turbine.
8. To study various Performance parameters of Pelton wheel.
9. To study various Performance parameters of Francis Turbines.
10. To study various Performance parameters of Kaplan turbines.
11. To study various Performance parameters of Centrifugal Pumps.
12. To study various Performance parameters of Rotary Compressors.
7. To study various Performance parameters of Gas Turbines.

Course Outcomes:

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

CO1	Explain the working principles of turbo machines and apply it to various types of machines .
CO2	Explain the working principle of various types of hydro turbines and know their application
CO3	Explain the working and governing of gas turbines.
CO4	Recognize and discuss today's and tomorrow's use of turbo machines for enabling a sustainable society.
CO5	Explain the working principles of Centrifugal compressors,Axial flow compressors

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	1	1	1	1	0	0	1	0	1	0
CO2	1	2	1	0	1	1	0	1	0	1	0	0
CO3	1	1	1	1	2	0	1	0	0	0	0	1
CO4	1	1	0	0	1	0	0	0	0	0	0	0
CO5	1	0	1	1	0	0	0	0	0	0	0	1

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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.) VI 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			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	IT601	PEC	Professional Elective - I	70	20	10	-	-	100	3	1	-	4
2	IT602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	IT603	PCC	Object Oriented Analysis and Design	70	20	10	30	20	150	3	-	2	4
4	IT604	PCC	Software Engineering	70	20	10	30	20	150	3	-	2	4
5	IT605	PCC	Internet and Web Technology	70	20	10	30	20	150	3	-	2	4
6	IT606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	IT607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	IT608	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 IT608 for the award of Honours (Minor Specialization).									

Note:1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I		
S.No.	**Subject Code**	**Subject Name**
1	IT601A	Information Theory and Coding
2	IT601B	E-Commerce and E-Governance
3	IT601C	Artificial Intelligance

List of Open Elective Course - II		
S.No.	**Subject Code**	**Subject Name**
1	IT602A	Microprocessor and Interfacing
2	IT602B	Intellectual Property Rights
3	IT602C	Digital Signal and Image Processing

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

DEAN Academic JEC, Jabalpur (M.P.)

Principal Jabalpur Engineering College

B.TECH. SIX SEMESTER (INFORMATION TECHNOLOGY)						
IT601 (Professional Elective - I) COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT601A	Information Theory and Coding	3	1	-	100	4

Module I

Introductory Concepts Information Theory: Entropy and Uncertainty; Information Content;

Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding Joint and conditional entropies, Mutual information -Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.

Module II

Compression Algorithms Optimal Compression; Compression Algorithms; Huffinan Coding; Adaptive Huffinan Compression; Statistical Modelling; Dictionary Based Compression; Sliding Window Compression; Speech Compression; LZW, RLE; Lossy Compression schemes; Image Compression using DCT.

Module III - Error Control Coding Coding for reliable digital transmission and storage; Types of codes; Error Checking codes; Error Correcting Codes; Coding Schemes; Linear Block Codes; Cyclic Codes; Error Trapping; Decoding for cyclic codes; Convolution codes. Run length encoding, CCIIT group 31-D compression, CCITT group 3 2D compression, CCITI group 4 2D compression.

Module **IV - Video Image Compression:** Requirement of full motion video compression. CITT H 261 Video coding algorithm, MPEG compression methodology. MPEG-2 compression, Audio (speech) compression.

Module **V - Cryptography:** Encryption, Decryption, Cryptogram (hypertext). Concept of cipher, Crypto analysis. **Keys:** Single key (secret key) cryptography, two-key (public-key) cryptography. Single key cryptography **Ciphers:** Block cipher codes, Stream ciphers, Requirement for secrecy, The Data Encryption Standard Public Key Cryptography: Diffle-Hellman public key distribution, The Rivest-ShamirAdelman (R-S-A) system for public key cryptography. Digital signature.

Reference Books:

1. Error correcting codes by W.W Peterson and E.J. Welton, The Mit Press (1978) ISBN 0262160390
2. Multimedia System Design by P.K. Andleigh & Kiran Thapar, Prentice Hall PTR Upper Saddle River, NJC (1996)
3. Bruce Schneier, Applied Cryptography: Protocol Algorithms & Source Code in C, John Wiley & sons, NY, 1994
4. Network Security by Stalking, PHI
5. Communication Systems, 3/e by Simon Haykin, John Wiley & sons (1995)

Information Theory and Coding (IT 601A)

CO 1. To get introduced with the various coding techniques.
CO 2. To analyze and compare various compression algorithms.
CO 3. To understand various types of coding schemes and error correction codes.
CO 4. To familiarize with the video and image compression.
CO 5. To understand the various cryptography techniques.

B.TECH. VI SEMESTER(INFORMATION TECHNOLOGY)						
IT 601 (Professional Elective-I) COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 601 B	E-Commerce, E-Business and E-Governance	3	1	-		4

Module I: Introduction to e-commerce: History of e-commerce, e-business models B2B, B2C, C2C, C2B, legal; environment of e-commerce, ethical issues, electronic data interchange, value chain and supply chain, advantages and disadvantages of e-commerce.

Module II: Electronic Payment Systems: Credit cards, debit cards, smart cards, e-credit accounts, e-money, Marketing on the web, marketing strategies, advertising on the web, customer service and support, introduction to m-commerce, case study: e-commerce in passenger air transport, Role of PSP,UPI,NPCI,BHIM.

Module III: E-Government, theoretical background of e-governance, issues in e-governance applications, evolution of e-governance, its scope and content, benefits and reasons for the introduction of e-governance, e-governance models-broadcasting, critical flow, comparative analysis, mobilization and lobbying, interactive services / G2C2G.

Module IV: E-readiness, e-government readiness, E- Framework, step & issues, application of data warehousing and data mining in e-government, Case studies: NICNET-role of nation wide networking in egovernance, e-seva.

Module V: E-Government systems security: Challenges and approach to e-government security, security concern in e-commerce, security for server computers, communication channel security, security for client computers.

References:-

1. Gary P. Schneider, "E-commerce", Cengage Learning India.
2. C.S.R. Prabhu, "E-governence: concept and case study", PHI Learning Private Limited.
3. V. Rajaraman, "Essentials of E-Commerce Technology", PHI Learning Private Limited.
4. David Whiteley, "E-commerce study , technology and applications", TMH.
5. J. Satyanarayan, "E-government: The science of the possible", PHI Learning Private Limited.
6. P.T. Joseph, "E-Commerce An Indian Perspective", PHI Learning Private Limited.
7. Hanson and Kalyanam, "E-Commerce and Web Marketing", Cengage Learning India.

E-Commerce, E-Business and E-Governance (IT 601B)

CO 1. Familiarize with e-commerce terms and e-business models.
CO 2. Distinguish among various electronic payment systems.
CO 3. Compare various e-governance models and their benefits.
CO 4. To provide approaches to various e-government security challenges.

B.Tech SIX SEMESTER (INFORMATION TECHNOLOGY)						
IT-601 (Professional Elective-I) COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 601C	ARTIFICIAL INTELLIGENCE	3	1	-		4

Module I: 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: 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: Probabilistic reasoning, Baye's theorem, semantic networks, scripts, schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Module IV: 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, Various techniques used in learning, introduction to neural networks, applications of neural networks, common sense, reasoning, some example of expert systems.

References:-

1 Rich E and Knight K, "Artificial Intelligence", TMH, New Delhi.

Nelsson N.J., "Principles of Artificial Intelligence", Springer Verlag, Berlin

Artificial Intelligence (IT 601C)

CO 1. To discuss and compare various search techniques in AI .
CO 2. Formulation of various knowledge representation schemes.
CO 3. Learn and differentiate among various game playing techniques.
CO 4. Apply AI learning techniques in the design of expert system.

B.TECH. SIX SEMESTER (INFORMATION TECHNOLOGY)						
IT 602 (Opn Elective-II) COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 602A	Microprocessor and Interfacing	3	-	—		3

Module I

Intel 8086 Microprocessor: Introduction to 16-bit microprocessors, 8086 pin functions, Minimum and maximum mode operations. 8086 Architecture, register organization, addressing Modes, 8086 Memory banks and Memory organization, 8086 Instruction set and Assembly language programming.

Module II

Advanced microprocessors: Salient features of advanced microprocessors. Review of evolution of advanced microprocessors: 186 / 286 / 386 / 486 / Pentium. Super scalar architecture of Pentium. 80286/386 Memory segmentation with descriptor tables, Privilege levels, Changing privilege levels, Paging including address translation, Page level protection, MMU, cache memory, Virtual memory.

Module III

I/O INTERFACING: Introduction to the interfacing chips 8255. Interfacing keyboards, printers, LEDS with Intel 8086 Microprocessor. Interfacing of 8254 programmable interval timer, 8259A Programmable interrupt controller & 8257 DMA controller with Intel 8086 Microprocessor.

Module IV

Memory Interfacing: Interfacing of RAM and ROM with Intel 8086 Microprocessor.

Serial communication interface: RS 232C standards, Interfacing of USART chip 8251 with Intel 8086 Microprocessor.

Module V

Microcontroller: Introduction to micro controller 8051, its architecture, Register set, operational features, pin description, I/O configuration, interrupts, addressing modes, an overview of 8051 instruction set.

Books

1. B.B. Brey (PHI), "The Intel Microprocessors, Architecture, Programming and Interfacing".
2. A Triebel & Avtar Singh (PHI), "The 8088 & 8086 Microprocessor".

3. D. Hall (Mc-Graw Hill), "Advanced Microprocessor and Interfacing".
4. A. Pal (TME), "Microprocessors Principles & Applications".
5. A.P. Mathur (TMA), "Introduction to Microprocessors". Intel Corporation Microprocessors Data manuals.
6. Microprocessor Training Inc., "Microprocessor Fundamentals & Applications (Handson)".

Suggested List of Program

1. **Write an 8086 ALP to find sum and average of 'n' integer numbers.**
2. **Write an 8086 ALP to find the factorial of a number.**
3. **Write an 8086 to find HCF of 2 unsigned 16-bit numbers.**
4. **Write an 8086 ALP to find LCM of 2, 16-bit unsigned numbers.**
5. **Write an 8086 ALP to print 'n' Fibonacci numbers.**
6. **Write an 8086 ALP to reverse a given string.**
7. **Write an 8086 ALP program to find the largest number from the array of numbers.**
8. **Write an 8086 ALP to perform Decimal to Binary conversions**
9. **Write an 8086 ALP to perform Decimal to Hexadecimal conversions**
10. **Write an 8086 ALP that reads a list of numbers and makes a count of Even and Odd numbers.**

Microprocessor and Interfacing (IT 502A)

CO 1. To understand the architecture of microprocessor 8086 and its instruction set.
CO 2. To study and compare architecture of various advanced microprocessors.
CO 3. To interface various peripherals with the microprocessor using support controllers.
CO 4. To give the overview of 8051 microcontroller.

B.TECH.. SIX SEMESTER (INFORMATION TECHNOLOGY)						
IT 602 (Opn Elective-II) COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 602B	Intellectual Property Rights	3	-	-		3

Module I

OVERVIEW OF INTELLECTUAL PROPERTY: Introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad Some important examples of IPR

PATENTS: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions, Granting of patent Rights of a patent, how extensive is patent protection, why protect inventions by patents, Searching a patent, Drafting of a patent, Filing of a patent, The different layers of the international patent system (national, regional and international options). Utility models, Differences between a utility model and a patent, Trade secrets and know-how agreements

Module II

COPYRIGHT: What is copyright, what is covered by copyright, how long does copyright last, why protect copyright,

RELATED RIGHTS: What are related rights, Distinction between related rights and copyright, Rights covered by copyright.

TRADEMARKS: What is a trademark, Rights of trademark, What kind of signs can be used as trademarks, types of trademark, function does a trademark perform, How is a trademark protected, How is a trademark registered, How long is a registered trademark protected for, How extensive is trademark protection, What are well-known marks and how are they protected, Domain name and how does it relate to trademarks.

Module III

GEOGRAPHICAL INDICATIONS: What is a geographical indication, How is a geographical indication protected, Why protect geographical indications.

INDUSTRIAL DESIGNS: What is an industrial design, How can industrial designs be protected, What kind of protection is provided by industrial designs, How long does the protection last, Why protect industrial designs.

NEW PLANT VARIETIES: Why protect new varieties of plants, How can new plants be protected, What protection does the breeder get, How long do the breeder's rights last, How extensive is plant variety protection.

UNFAIR COMPETITION: What is unfair competition, relationship between unfair competition and intellectual property laws.

Module IV

ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS: Infringement of intellectual property rights, Enforcement Measures, EMERGING ISSUES IN.

INTELLECTUAL PROPERTY: Overview of Biotechnology and Intellectual Property, Biotechnology Research and Intellectual Property Rights Management, Licensing and Enforcing Intellectual Property, Commercializing Biotechnology Invention, **Case studies** of Biotechnology, **Case studies** of patents in other areas.

Module V

IT ethics: Theoretical basis of Computer Ethics, defining Computer Ethics, computer professional's behavior, and social conduct, ease of misuse, do and don'ts with proprietary data, Understanding computer crime, Social Networking, Understanding Software Compliance, Software Piracy, Software/OS licensing Policies, Understanding Professional Responsibility, IT act provisions.

TEXT BOOKS

T. M Murray and M.J. Mehlman, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000

REFERENCES

1. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew, Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985

2. D.Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002

3. Bourgagaize, Jewell and Buiser, Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.

4. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006

5. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000

6. P. Narayanan; Law of Copyright and Industrial Designs;Eastern law House, Delhi , 2010

Intellectual Property Rights (IT 602B)

CO 1. To judge the need of Intellectual Property Rights.
CO 2. To recommend patent systems to protect inventions.
CO 3. Compare copyrights, trademarks and related terms.
CO 4. To relate unfair competition and IPR.
CO 5. Understand the computer crime and IT Act provisions.

B.Tech SIX SEMESTER (INFORMATION TECHNOLOGY)						
COURSE CONTENT (AICTE w.e.f. July 2019)						
IT-602 (Open Elective-II)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT602C	DIGITAL SIGNAL AND IMAGE PROCESSING	3	-	-		3

COURSE CONTENTS

Module-I

Introduction and Fundamentals
Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

Image Enhancement in Spatial Domain
Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

Module -II

Image Enhancement in Frequency Domain
Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

Image Restoration
A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

Module -III

Color Image Processing
Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation.

Morphological Image Processing
Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

Module -IV

Registration
Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging– Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation
Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

Module -V

Feature Extraction
Representation, Topological Attributes, Geometric Attributes
Description
Boundary-based Description, Region-based Description, Relationship.
Object Recognition
Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching

Books:
1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.

2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.

3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

4.Digital Image Processing by A.K. Jain, 1995,-PHI

Digital Signal and Image Processing (IT602C)

CO 1. To get introduced with the basic concept of image formation, acquisition and digitization of an image.
CO 2. To understand restoration and numerical value analysis of image in different applications.
CO 3. To distinguish among various color image processing and morphological image processing.
CO 4. To compare various segmentation techniques.

B.Tech SIX SEMESTER (INFORMATION TECHNOLOGY)						
COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 603	Object Oriented Analysis and Design	3	-	2		4

Module I

Overview of Object Oriented concepts: Objects and classes, abstraction, generalization and inheritance, encapsulation, multiple inheritance, aggregation abstraction classes, polymorphism, link and association, Need for object oriented approach

Module II

System design life cycle, object oriented S/W development process model, Object Oriented Analysis, Object Modeling Technique (OMT): object model, function model, relationship among models, object diagrams, state diagrams, data flow diagrams, analysis.

Module III

Object oriented Design: Overview of object design, Combination the models, Designing algorithms, design optimization, Implementation of control, Adjustment, Design of association, object representation, physical packaging, documenting design decision, comparison of use-case driven approach.

Module IV

Translation Object Oriented design into implementation, Programming style, Documentation, characterization of object oriented languages, Comparison of object oriented language like C++, JAVA, object programming.

Module V

Unified Modeling Language (UML): Class diagram sequence diagram Use case diagram, Collaboration, diagram, state, chart diagram, Activity diagram, component diagram, deployment diagram, Object oriented Database: Relational Vs .object oriented database, the architecture of object oriented database, query language for Object Oriented database.

References:-

1. Satzinger, Jackson and Burd, "Object oriented Analysis and design with the Unified Process", CENGAGE Learning.

2. Michael Blaha and J. Rumbugh, "Object oriented Modeling and design with UML", Pearson Education
3. O'Docherty, "Object Oriented Analysis and Design Understanding, System Development with UML2.0", Wiley India.

Object Oriented Analysis and Design (IT-603)

CO 1. To understand the principles used in OOP and its elements.
CO 2. To introduce with the object oriented software development process model.
CO 3. To compare the features of object oriented languages like C++,java etc.
CO 4. To familiarize with the UML, object oriented database and query language for OO Database .

B.Tech SIX SEMESTER (INFORMATION TECHNOLOGY)						
COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 604	Software Engineering	3	-	2		4

Module I: The Software Product and Software Process:
Software Product and Process Characteristics, Software Process Models: Linear Sequential Model, Prototyping Model, RAD Model, Evolutionary Process Models like Incremental Model, Spiral Model, Component Assembly Model, RUP and Agile processes. Software Process customization and improvement, CMM, Product and Process Metrics

Module II: Requirement Elicitation, Analysis, and Specification
Functional and Non-functional requirements, Requirement Sources and Elicitation Techniques, Analysis Modeling for Function-oriented and Object-oriented software development, Use case Modeling, System and Software Requirement Specifications, Requirement Validation, Traceability

Module III: Software Design
The Software Design Process, Design Concepts and Principles, Software Domain Modeling and UML, Architectural Design, Architectural Views and Styles, User Interface Design, Object-Oriented Design, Subsystem design, Object design, Function-oriented Design, Dataflow diagrams, Context diagram, SA/SD design method.

Module IV: Software Analysis and Testing
Software Static and Dynamic analysis, Code inspections, Software Testing Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, Test Oracles, Test Techniques, Black-Box Testing, White-Box Unit Testing and Unit Testing Frameworks, Integration Testing, System Testing and other Specialized Testing, Test Metrics, Testing Tools.

Module V: Software Maintenance & Software Project Measurement
Need and Types of Maintenance, Software Configuration Management (SCM), Software Change Management, Version Control, Change control and Reporting, Program Comprehension Techniques, Re-engineering, Reverse Engineering, Tool Support. Project Management Concepts, Feasibility Analysis, Project and Process Planning, Resources Allocations, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance (SQA). Project Plan, Project Metrics.

Practical and Lab work
Lab work should include a running case study problem for which different deliverables at the end of each phase of a software development life cycle are to be developed. This will include modeling the requirements, architecture and detailed design. Subsequently the design models will be coded and tested. For modeling, tools like Rational Rose products. For coding and testing, IDE like Eclipse, Net Beans, and Visual Studio can be used.

Text Book:
Pankaj Jalote ,"An Integrated Approach to Software Engineering", 3rd Edition, Narosa Pub, 2005.

Reference Books:

1. R S. Pressman ,"Software Engineering: A Practitioner's Approach", Sixth edition 2006, McGraw-Hill.

2. Rajib Mall, "Fundamentals of Software Engineering" Second Edition, PHI Learning.

3. Sommerville,"Software Enginerring",Pearson Education.

4. Richard H.Thayer,"Software Enginerring & Project Managements",Willey India

5. Waman S.Jawadekar,"Software Enginerring", TMH.

6. Schwalbe,"IT Project Managements",Cengage Learning.

Suggested List of Program

1. Introduction to UML and Course Outlines. Tools Description
2. Introduction to Rational Rose and Practical Implementation
3. Introduction to class Diagram
4. Class Diagram in Detail and Tasks Done by using Rational Rose
5. Introduction to Use-case Diagram, its Detail and implementation by using Rational Rose
6. Lab Quiz: 01 (Use-case Diagram)
7. Introduction to Sequence Diagram
8. Sequence Diagram in Detail and Tasks by using Rational Rose
9. Introduction of Component Diagram and its implementation by using Rational Rose
10. Introduction to Collaboration Diagram and Task by using Rational Rose
11. Test cases and Few Scenarios of test-cases in real life
12. Introduction to TestLog and An implementation on it

Software Engineering (IT 604)

CO 1. To study various software process models.
CO 2. To understand the requirement elicitation, analysis and specification.
CO 3. To familiarize with the software design process.
CO 4. To analyze and compare various software analysis and testing methods.
CO 5. To understand the software maintenance and software project measurement.

B.Tech SIX SEMESTER (INFORMATION TECHNOLOGY)						
COURSE CONTENT (AICTE w.e.f. July 2019)						
SUB. CODE	SUB. NAME	L	T	P	MAX. MARKS	CREDITS
IT 605	Internet and Web Technology	3	-	2		4

Module I

An Introduction to Web Engineering, History of web Development, Time line, Motivation, Categories of Web Applications, Characteristics of Web Applications. Evolution and Need for Web Engineering, Web Engineering Models, Software Engineering v/s Web Engineering. Introduction to Browser and search engines, Search fundamentals, Search strategies, Directories search engines and Meta search engines, Working of the search engines, Miscellaneous Web Browser details.Introduction to Web Servers: Features of web servers, caching, case study-IIS, Apache, Configuring web servers.

Module II

Technologies for Web Applications: HTML and DHTML, HTML Basic Concepts, Static and dynamic HTML, Structure of HTML documents, HTML Elements, Linking in HTML, Anchor Attributes, Image Maps, Meta Information, Image Preliminaries, Layouts, Backgrounds, Colors and Text, Fonts, Tables, Frames and layers.

Database integration, CSS, Positioning with Style sheets. Introduction to JAVA SCRIPT, Cookies Creating and Reading Cookies

Module III

Technologies for Web Applications: Introduction of XML, Validation of XML documents, DTD, Ways to use XML, XML for data files, HTML Vs XML, Embedding XML into HTML documents, Converting XML to HTML for Display, Displaying XML using CSS and XSL, Rewriting HTML as XML.

Module IV

Creating Cohesive Websites: Conceptual Overview of website Development, Website Design issues, Conceptual Design, High-Level Design, Indexing the Right Stuff, Grouping Content. Architectural Page Mockups, Design Sketches, Navigation Systems. Searching Systems Good & bad web design, Process of Web Publishing. Phases of Web Site development, enhancing your web-site, submission of website to search engines. Web security issues, security audit of websites, Web effort estimation, Productivity, Measurement, Quality usability and reliability.

Module V

Requirements Engineering for Web Applications: Introduction, Fundamentals, Requirement Source, Type, Notations Tools. Principles Requirements Engineering Activities, Adapting RE Methods to Web Application.

Introduction to http and https, http vs. https, Dynamic Web Content, Introduction of ASP.Net, PHP, Database connectivity (MySQL/Oracle)

TERM WORK

1. At least ten practical experiments based on above syllabus and a mini project is desirable to be completed by a group of three that cover following tools.
   - HTML
   - DHTML
   - XML
   - Java Script

Recommended Books:

1. Roger S.Pressman, David Lowe, "Web Engineering", Tata Mcgraw Hill Publication, 2007
2. Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill
3. Gopalan N P, Akilandeswari "Web Technology: A Developer s Perspective" , PHI

4. NEIL GRAY "Web server Programming" Wiley
5. CHRIS BATES Web Programming: Building Internet applications Wiley
6. Moller, "An Introduction to XML and Web Technologies" , Pearson Education New Delhi, 2009
7. Beginning XML 4th Edition Hnter, Refter, Fawset Wiley India
8. Internet & World Wide Web How to Program, Pearson education, 3rd edition, by: H.M. Deitel, P.J. Deitel, A.B. Goldberg.
9. C. Xavier, "Web Technology & Design ", Tata McGraw Hill. 10 Ivan Bay Ross, "HTML, DHTML, Java script, Perl CGI", BPB

Suggested list of Practical

1. Introduction to major internet protocol- HTTP, FTP, SMTP
2. Study of Web Browser- Microsoft Internet Explorer and Netscape Navigator.
3. Their Network options, security features, Cookies, file cashing, temporary files etc.
4. HTML- Basics of HTML., text, image, other MIME types, lists, tables,
5. HTTP methods, forms.
6. Multimedia on the Web- Embedding audio and video files in HTML
7. Java Script- Introduction to Java Script for client side validation.
8. Serves side scripting – Introduction to fundamentals concepts of ASP or JSP or PHP (any one platform depending on instructor).
9. Basics of CGI scripting using Perl or C.
10. Simple examples of request/ response objects.
11. Basic introduction to web solutions architecture.

Internet and Web Technology (IT 605)

CO 1. To get introduced with the web engineering ,its evolution and applications.
CO 2. To understand various web technologies.
CO 3. To give the overview of the website development.
CO 4. To understand various web servers and their services.

Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	ME601	PEC	Professional Elective - I	70	20	10	-	-	100	3	1	-	4
2	ME602	OEC	Open Elective-II	70	20	10	-	-	100	3	-	-	3
3	ME603	PCC	Heat & Mass Transfer	70	20	10	30	20	150	3	-	2	4
4	ME604	PCC	Metal Cutting & Machine Tools	70	20	10	30	20	150	3	-	2	4
5	ME605	PCC	Industrial Engineering & Management	70	20	10	30	20	150	3	-	2	4
6	ME606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	ME607	MC	Summer Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	ME608	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 ME608 for the award of Honours (Minor Specialization).									

Note: 1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I		
S.No.	Subject Code	Subject Name
1	ME601A	Solid Mechanics
2	ME601B	Alternate Automotive Fuels & Emission
3	ME601C	Finite Element Method

List of Open Elective Course - II		
S.No.	Subject Code	Subject Name
1	ME602A	Power Plant Engineering
2	ME602B	Intellectual Property Right
3	ME602C	Advanced Materials

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

DEAN Academic IEC, Jabalpur (M.P.)

Principal Jabalpur Engineering College

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

Credits: 4	PEC	ME-601 A	Solid Mechanics	L: 3, T: 1, P: 0

Course Objective:

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

1. *The theory of elasticity including strain/displacement and Hooke's law relationships*
2. *Analyze solid mechanics problems using classical methods and energy methods*
3. *Obtain stresses and deflections of beams on elastic foundations*

COURSE CONTENTS:

Module-1: Strain Energy or Resilience:
Strain Energy- Elastic, plastic and rigid members, Stresses due to different types of axial loading, Gradually applied loads, Impact loads, Deflection of beam using strain energy method, Strain energy stored due to bending, The first theorem of Castigliano and its applications, Laminated Springs or Leaf springs.

Module-2: Conjugate Beam Method, Propped Cantilevers and Beams:
Conjugate Beam Method: Deflection and slope of simply supported beam (point load at the centre, carrying an eccentric point load), Relation between actual beam and conjugate beam.
Propped Cantilever And Beam: Shear force and Bending moment for a propped cantilever carrying (point load at the centre and propped at the free end, uniformly distributed load and propped at the free end).

Module- 3: Fixed Beam And Continuous Beam: Relation between the free B.M. diagram and the fixed B.M. diagrams, Slope and deflection, Effect of sinking of supports, Fixed beam subjected to couple, Degree of fixity, Advantages and disadvantages of fixed beam, Clapeyron's theorem of three moments, Column Analogy method.

Module-4: Thick Cylindrical Shells:
Introduction, Stresses in a thick cylindrical shell, Lamme's equation, Hoop stresses and radial pressure distribution, Stresses in Compound thick cylinders, Thick spherical shells.

Module-5: Theories of Failures:
Maximum normal stress theory; Maximum shear stress theory; Principal stress theory; Maximum normal and shear strain energy theory; Maximum distortion energy theory; Application of theories to different materials and loading conditions.

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

References:

1. Beer FP,Johnson Mechanics of Materials, Sixth Edition; Mc Graw Hills.
2. Stephen Timoshenko; Strength of materials;part1&2; CBS Pub.
3. Singh Arbind K; Mechanics of Solids; PHI
4. R Subramannian, Strength of materials OXFORD University press, Third Edition.

5. Egor P.Popov; Engineering Mechanics Of Solids; PHI
6. S Ramamurthum, Strength of materials,Dhanpat Rai.

Course Outcomes:

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

CO1	Estimate strain energy stored due to bending.
CO2	Calculate Shear force, Bending moment, Slope and deflection in Beams.
CO3	Analyze stresses in thick cylinders and spheres.
CO4	Design elements of machine, structure and members by using different theories of failures.

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	2	-	-	-	-	-	-	-	-	-
CO2	2	1	2	-	-	-	-	-	-	-	-	-
CO3	2	1	2	-	-	-	-	-	-	-	-	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-

Jabalpur Engineering College, Jabalpur (M.P)

Programme: B.Tech Mechanical Engineering (VI-Semester) AICTE

CREDITS: 4 PEC ME- 601(B) - Alternative Automotive Fuels & Emission L:3, T: 1, P: 0

Course Objective:

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

1. Different types of automobile fuels
2. The characteristics of different automobile fuels
3. The effect of different automobile fuels on emission
4. The Norms on emissions and different emission standards.

Course Content:

Module-1: **Introduction Automobile Fuels:**

Classification of Automobile alternative fuels(liquid, gaseous, hydrogen, LPG, CNG, Biogas etc.), Desirable characteristics of SI & CI engine alternative fuels, Rating of SI & CI engine fuels, Introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars. merits and demerits of various alternate fuels.

Module-2: **Liquid alternative fuels:**

Vegetable Oils: Various vegetable oils for automobile engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics. Alcohols: Properties as engine fuel, alcohols and gasoline blends, performance in automobile engine, methanol and gasoline blends.

Module-3: **Gaseous Fuels:**

Biogas: Introduction to Biogas system, Process during gas formation, Factors affecting biogas formation. Usage of Biogas in SI engine & CI engine., Properties of Natural gas, Hydrogen gas, LPG & CNG as engine fuels, storage and handling, performance and safety aspects to all gaseous fuel, fuel metering systems.

Module- **4: Automobile emissions:**

Types of automobile emissions, emission characteristics, formation of automobile emissions, mechanism of HC , CO and NO in SI engine, exhaust emission and factors affecting the emission, evaporative emission, crankcase emission, lead emission CI engine emissions: formation of smoke, factors affecting the smoke formation, unburned hydrocarbons, carbon monoxide, oxides of nitrogen, smog and comparison of diesel and petrol emissions.

Module- **5:Emissions Norms & Measurement:**

Emission norms as per Bharat Standard up to BS – IV and procedures for confirmation on production. Demerits of automobile emission to environment. Types Of Catalytic Conversion, Measurement Techniques Emission Standards and Test Procedure NDIR,FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards

References: 1. J.B. Heywood. Internal combustion Engines, Wiley
2. Ganeshan V; Internal Combustion engines; TMH
3. Mathur M L & Sharma RP; A. Course in IC engines; DhanpatRai
4. R Yadav, Internal Combustion Engines
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 Engineering (Palgrave Mc Millan)

Course Objective: On the Successful Completion of the course the Student will be able to:

CO1	Define different types of fuel.
CO2	Differentiate Different types of automobile fuels.
CO3	Analyse the emissions of different automobile fuels.

Mapping of Course Outcomes with Program Outcomes:

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

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

Credits: 4	PEC ME-601C (Finite Element Method)	L: 3, T: 1, P: 0

Course Objectives:

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

1. *The fundamental concepts of the theory of the finite element method.*
2. *The use of the basic finite elements for structural applications using truss, beam, frame, and plane element*

Course Contents:

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.

MODULEII 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, Axisymmetirc 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, 1D 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.

MODULEV 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 mode shapes, Use of commercial software packages.

References:

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

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	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 1D and 2D FEA Problems.
CO4	Apply the finite element analysis using available commercial FEA tools.

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	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	1	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	2	-	3	-	-	-	-	-	-	-

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

Credits: 3	OEC	ME-602A	Power Plant Engineering	L: 3, T: 0, P: 0

Course Objective:

1. *Understanding the process of converting various renewable energy sources to electric power, Layout of renewable energy power plant and their advantages and limitations*
2. *Understand layout of working principle of fossil thermal power plant. & co-generation system, including coal handling system, pulverization of coal, steam generation system, steam turbine, condenser, cooling tower and control systems.*
3. *Understand the layout of nuclear power plant, nuclear fuels & chain reactions, components and working principle of different types of nuclear power plants.*
4. *Understand the layout of hydroelectric power plant with plant components, hydrology- hydrographs, flow duration curve, mass curve & power control systems.*
5. *Understand the power plant economics, estimate the prediction loads, and factors.*

COURSE CONTENTS:

MODULE I: Renewable Energy Power Plants: Introduction to methods of converting various energy sources of electric power, direct conversion methods renewable energy sources, solar, wind, tidal, geothermal, bio-thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter.

MODULE II: Fossil Fuel Steam Stations: Basic principles of station design, recent trends in turbine and boiler sizes and steam conditions, plant design and layout, outdoor and indoor plant, system components, fuel handling, burning systems, feed water treatment plant, condensing plant and circulating water systems, cooling towers, turbine room and auxiliary plant equipment., instrumentation, testing and plant heat balance. Combined cycle power generation, heat recovery steam generator, co-generation plant.

MODULE III: Nuclear Power Station: Importance of nuclear power development in the world and Indian context, Review of atomic structure and radio activity, binding energy concept, fission and fusion reaction, fissionable and fertile materials, thermal neutron fission, important nuclear fuels. moderators and coolants, Types of reactors, pressurized water reactor, boiling water reactor, breader reactor, CANDU reactor, gas cooled reactor,

MODULE IV: Hydro-Power Station: Classification of hydroelectric power plant, introduction to hydrology, plant layout, hydro plant auxiliaries, cost of plant, life of plant, hydro power control, electrical and mechanical components, comparison of hydro power station with thermal power station, automatic and remote control of power plant, safety measures and preventive maintenance of hydro power plant, calculation of available hydro power.

MODULE V: Power Station Economics: Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor and their influence on plant design, operation and economics; comparison of hydro and nuclear power plants typical cost structures, simple problems on cost analysis, economic performance and tariffs, interconnected system and their advantages, elements of load dispatch in interconnected systems.

References:

1. Nag PK; Power plant Engg; TMH
2. Al-Wakil MM; Power plant Technology; TMH
3. Sharma PC; Power plant Engg; Kataria and sons, Delhi
4. Domkundwar; Power Plant Engg; Dhanpatrai & sons.
5. Rajput RK; A text book of Power plant Engg.;Laxmi Publications.
6. Yadav R; Steam and gas turbine and power plant engg by

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

CO1	Define the procedure of site selection for power plant and able to know the procedure to convert renewable, fossil fuel energy, nuclear energy & fluid energy in to electric power
CO2	Explain function of different mechanism of power plant like fuel handling, its combustion , Utilization of potential of energy to convert in power by using mechanical and electrical equipments.
CO3	To draw the layout of power plant like renewable energy based , fossil fuel based, hydro and nuclear based power plants.
CO4	Estimate the power plant load, maximum demand, load factors, diversity factor, plant factor and their influence on plant design, operation and economics.

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	1	-	-	-	-	-	-	-	-	-
CO3	-	1	2	-	-	-	-	-	-	-	-	-
CO4	-	1	2	-	-	-	-	-	-	-	-	-

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

Credits: 3	OEC ME602B Intellectual Property Rights	L: 3, T: 0, P: 0

Course Objective:

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

1. *Concepts of Intellectual Property Rights & Copyright issues.*
2. *Patent, Trade Marks, Designs & GI terminologies*
3. *Contemporary Issues & Enforcement of IPR*

COURSE CONTENTS:

MODULE **I Introduction**

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- Copyright, Patent, TradeMarks Designs, Geographic indication, layout design of Semiconductors, Plant varieties, Concept & Meaning of Intellectual Property.

Major international documents relating to the protection of IP - Berne Convention, Paris Convention, TRIPS. The World Intellectual Property Organization (WIPO).

MODULE **II Copyright**

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, Civil, Criminal, Administrative, Registration Procedure.

MODULE **III Patents**

Meaning and historical development. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory license, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

MODULE **IV – Trade Marks, Designs & GI**

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

MODULE **V Contemporary Issues & Enforcement of IPR**

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology,Ecommerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House
2. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, 2014
3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.
4. AnandPadmanabhan, Enforcement of Intellectual Property, Lexis NexisButterworths, Nagpur, 2012.
5. Managing Intellectual Property the Strategic Imperative, Vinod V. Sople, PHI.
6. PrabuddhaGanguli, "Intellectual Property Rights" Mcgraw Hill Education, 2016.

Evaluation

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

Course Outcomes:

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

CO1	Outline the concept of Intellectual Property Rights & Copyright issues.
CO2	Assess patent, Trade Marks, Designs & GI terminologies and terms.
CO3	Discuss Contemporary Issues & Enforcement of IPR.

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	-	3	-	-	-	1
CO2	1	-	-	1	-	1	-	2	-	-	-	1
CO3	1	-	-	-	-	1	-	2	-	-	-	1

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

Credits: 3	OEC ME-602C	Advanced Materials	L: 3, T: 0, P: 0

Course Objectives:

The purpose of this course is to introduce the undergraduate students with

1. *To understand characteristics and behavior of ferrous and non-ferrous alloys.*
2. *Knowledge of high temperature materials and nuclear materials.*
3. *To provide an overview of advanced materials and their applications.*
4. *To perform selection of materials for various applications.*

Course Contents:

1: Ferrous Metals and Alloys

Developments in Iron Making and Steel Making: Overview of iron making, steel making, refining and continuous casting processes; indicative process calculations; environmental considerations; quality issues in steel plant operations.

Steel Making: Modifications of steel making converter operations; developments such as sub lance and dynamic control of steel making, secondary treatment including ladle metallurgy and injection metallurgy; continuous steel making; illustrative numerical problems

Specifications of Steels: Types of steels, alloy steels, tool steels; stainless steels, HSLA, TRIP steels, TWIP steels. Types of cast irons – compositions, properties and applications, specific heat treatment.

2: Non-ferrous Alloys

Aluminium and its alloys: Physical chemical and mechanical properties, classifications, heat treatable and non-heat treatable types - structural features corrosion behaviour; cladding and other methods of corrosion protection.

Titanium and its alloys: physical, chemical and mechanical properties of titanium, effect of other elements on its properties, types of titanium alloys, microstructural features, properties and applications.

Magnesium and its alloys: structure, properties and applications of magnesium and some of its alloys; metallurgy of magnesium castings; Lead, tin, zinc, antimony, silver, gold and platinum alloys, properties and applications.

3: High Temperature Materials and Nuclear Materials

High Temperature Materials: Iron base, nickel base and cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase - embrittlement, solidification of single crystals.

Nuclear Materials: Overview of nuclear scenario in India, nuclear scenario at international level. Material requirements – structural materials, coolants, shielding materials and fuel rods – fabrication requirements. Nuclear irradiation effects on structural materials – safe guards, safety and health protection.

Unit 4: Polymers, Plastics and Composites

Polymers: Structure of polymers, characterization and applications of polymers: mechanical behavior of polymers, strengthening of polymers, crystallization and glass transition phenomenon and types of polymers.

Plastics: Design and selection of plastics, structure property correlation, mechanical properties, degradation, wear and friction, thermal, electrical and optical properties, flammability of plastics and processing of plastics and FRP.

Composites: Particle reinforced composites, fiber reinforced composites – influence of fiber length, orientation and concentration. Fiber phase, matrix phase, metal matrix composites, polymer matrix composites, ceramic matrix composites, carbon – carbon composites, hybrid composites and structural composites.

Unit 5: Ceramics and Bio materials

Ceramics: Ceramics as a class of material, classification of ceramics, bonding and structure of various ceramic materials; crystal structure and defects; chronological developments, structure of silicates; polymorphic transformations, raw materials.

Bio Materials: Introduction to biomaterials; need for biomaterials; Salient properties of important material classes; Property requirement of biomaterials; Metallic implant materials, ceramic implant materials, polymeric implant materials, composites as biomaterials; Orthopedic, dental and other applications. Biomaterials worldwide market, technology transfer and ethical issues; Standards for biomaterials and devices.

References:

1. Avner S. H., 'Introduction to Physical Metallurgy', 2nd Edition, McGraw Hill, 1974.
2. Leslie W. C., 'The Physical Metallurgy of Steels', McGraw Hill, 1982.
3. Pickering P. B., 'Physical Metallurgy and the Design of Steels', Applied Science Publishers, 1983.
4. Brick R. M., Gorden R. B, Phillips A., 'Structure and Properties of Alloys', McGraw Hill, 1965.
5. Polmear I. J., 'Light Alloys -Metallurgy of the Light Metals', 3rd Edition, Arnold, 1995.
6. Thomas H. Courtney, "Mechanical Behavior of Materials", 2nd Edition, 2013, Overseas Press India Private Limited.
7. Rose R. M., Shepard L. A., Wulff J., 'Structure and Properties of Materials', Volume III, John Wiley, 1984.
8. M.F. Ashby, "Materials Selection in Mechanical Design' – Third edition, Elsevier publishers, Oxford, 2005.
9. Tupkary R.H., 'Introduction to Modern Steel Making', Khanna Publishers, 2004 (primary text).

Evaluation:

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

List of Experiments:

1. Make a selection of steels available in the market as per given application.
2. Study of properties and applications of High Temperature Materials.
3. Study of properties and applications of Nuclear Materials.
4. Study of properties and applications of Polymers, Plastics and Composites.
5. Processing of Composites.
6. Properties,selection and applications of biomaterials in engineering.

Course Outcomes:

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

CO1	Outline the properties of Ferrous & Non-ferrous metals and their alloys.
CO2	Identify High Temperature Materials and Nuclear Materials
CO3	Analyze different materials like Polymers, Plastics,Composites, Ceramics and Bio materials for their properties and 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	1	-	-	-	-	-	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	1
CO3	2	-	1	1	-	-	-	-	-	-	-	1

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

Credits:4	PCC	ME-603	Heat & Mass transfer	L: 3, T: 0, P: 2

Course Objective:

1. Understand the application of various experimental modes of heat transfer i.e. conduction convection, radiation and solve problems related to heat transfer and learn about critical thickness of insulation.

2. Extend the conduction and convection laws in extended surfaces and solve unsteady state heat transfer problems applied to various applications.

3. Categories the free and forced convection processes and utilizes empirical relations for laminar and turbulent flow.

4. Solve heat exchanger problems using LMTD and NTU methods with the help of heat transfer data book and learn the basics of mass transfer.

5. Understand boiling and condensation phenomena and the laws of radiation and solve problem related to radiation heat transfer for black body and gray body.

COURSE CONTENTS:

Module: 1 **Basic Concepts:** Modes of heat transfer,StefanFourier'sBoltzmanlaw;law, Newthermal resistance and conductance, analogy between flow of heat and electricity, combined heattransfer process;

Conduction: Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.

Module: 2 **Extended surfaces (fins):** Heat transfer from a straight and annular fin (plate) for a uniformcross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications;

Unsteady heat conduction: Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.

Module: 3 **Convection:** Introduction, free and forced convection; principle of dimensional analysis, Buckinghamrem,'publication three-dimensional analysis of free 'and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

Module: 4 **Heat exchangers**: Types- parallel flow, counter flow; evaporator an condensers, overall heat transfers coefficient, fouling factors, log-mean temperature difference (lmtd), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method;

Mass transfer: Fick's law,-molar diffusion,equidiffusion coefficient, analogy with heat transfer,diffusion of vapour in a stationary medium.

Module: 5 **Thermal radiation**: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from area between black and gray surfaces, shape factor, analogical electrical network, radiation shields.

Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wisecondensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

References:

1. Sukhatme SP; Heat and mass transfer; University Press Hyderabad
2. Holman JP; Heat transfer; TMH
3. Dutta Binay K; Heat Transfer; PHI
4. Kumar DS; Heat and mass transfer; SK Kataria and Sons Delhi
5. Kreith; Heat transfer,
6. Sachdeva RC; Fundamentals of engineering heat and mass transfer,.
7. Gupta & Prakash; Engineering heat transfer,

EVALUATION:

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

COURSE OUTCOMES:

Upon successful completion of this course the student will be able to:

CO1	Illustrate the real time applications of fluid, solid medium and radiation heat transfer,
CO2	Utilize the knowledge of design skills of heat transfer problems for different boundary conditions
CO3	Examine the real time applications of heat transfer equipments under different conditions
CO4	Estimate the heat transfer rate for various complex conditions

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

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

LIST OF EXPERIMENTS :

1 Conduction through a rod to determine thermal conductivity of material
2 Forced and free convection over circular cylinder
3 Free convection from extended surfaces
4 Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate
5 Calibration of thermocouple
6 Experimental determination of Stefen-Boltzman constant

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

CO1	Analyze conduction , convection and radiation heat transfer processes
CO2	Illustrate the working of various heat transfer equipments

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	-	-	-	2	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-

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

Credits:4	PCC	ME-604 Metal Cutting & Machine Tools	L: 3, T:0 , P: 2

Course Objective:

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

1. *The course provides students with fundamental knowledge and principles in material removal processes.*
2. *The fundamentals of machining processes and machine tools.*
3. *Importance of metal cutting parameters.*

Course Contents:

MODULE **I: Lathe**: Classification of machine tools and their basic components; lathe- specification, components & accessories, various operations on lathes, capstan & turret lathes, tool layout, methods of thread production, machining time, single point cutting tools, tool signature and nomenclature

MODULE **II: Grinding**: Types of grinding machines, surface, cylindrical and internal grinding, grinding wheels, specifications, wheel turning and dressing without eccentricity, centre-less grinding.

MODULE **III: Milling:** Vertical, horizontal and universal type machines, specifications and classifications of milling machines, universal dividing head plain and different indexing, gear cutting, milling cutters.

Drilling & Broaching: Fixed spindle, radial and universal drilling machines, drilling time, broaching principle, broaches and broaching machines.

MODULE **IV: Shapers**: Classification and specifications, principle parts, quick return mechanism, shaper operations, speed feed, depth of cut, machining time. Surface qualities, equipment used for rating surfaces, rms. CLA value, causes for surface irregularities.

Gear Cutting: Die casting, methods of forming gears, generating process, Gear shaping, gear shaving, gear grinding gear testing.

MODULE **V: Tool Wear, Tool Life and Machinability:** Tool wear mechanisms, Types of tooldamage during cutting, Wear and chipping characteristics of different tool materials, Tool wearequations, tool failure criteria, Tool life equations, Effect of process parameters on Tool life, Toollife testing, Machinability, Surface finish and surface integrity.

References

1. Rao PN; Manufacturing Technology vol I and II; TMH.
2. HazraChadhary; Workshop Tech.II; Media Promoter and Pub.
3. Lindberg RA; Processes and Materials of Manufacturing; PHI.
4. Raghuvanshi;BS; Work shop technology Vol-I, II; Dhanpat Rai Delhi.
5. Alciatori DG, Histand MB; Introduction to Mechatronics andMeasurement system; TMH.
6. HMT; Production Processes; TMH.

List of Experiments

1. To make a job on lathe machine with all operations like turning, step turning, drilling, tapper turning, thread cutting and knurling.
2. Study of center less grinding machine/ tool and cutter type grinding machine.
3. Study of horizontal/ universal milling machine, dividing head and indexing mechanism of it.
4. To cut a spur gear on milling machine using rapid indexing method.
5. Study of radial drilling machine and preparing a job on it.
6. To study a sapping machine to learn about working of quick return mechanism.

Evaluation

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

Course Outcomes:

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

CO1	Classify conventional machine tools and their components.
CO2	Demonstrate working and operations of machine tools such as lathe, milling, grinding machines.
CO3	Analyze and Estimation of Tool Wear, its variables and 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			1	2	1	1						1
CO2				1	1	1						
CO3				2	2		1					

Course Outcomes: Metal Cutting & Machine Tools Lab:

List of Experiments

1. To make a job on lathe machine with all operations like turning, step turning, drilling, tapper turning, thread cutting and knurling.
2. Study of center less grinding machine/ tool and cutter type grinding machine.
3. Study of horizontal/ universal milling machine, diving head and indexing mechanism of it.
4. To cut a spur gear on milling machine using rapid indexing method.
5. Study of radial drilling machine and preparing a job on it.
6. To study a sapping machine to learn about working of quick return mechanism.

Course Outcomes: Metal Cutting & Machine Tools Lab:

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

CO1	Learn to build a job on lathe machine.
CO2	Experiments with Grinding machine and operations.
CO3	Illustrate the working and operations of milling machine.
CO4	Demonstration 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	2	0	1	1	1	1	0	0	0	0	1
CO2	0	0	1	1	0	1	0	0	1	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	2

JABALPUR ENGINEERING COLLEGE, JABALPUR (M.P.)
PROGRAMME: B.Tech MECHANICAL ENGINEERING (VI SEMESTER) AICTE
CREDITS: 4 PCC ME- 605 - Industrial Engineering &Management: L:3, T: 0, P: 2

COURSE OBJECTIVE:

1. *To be familiar with production, planning and inventory controltechniques used in industrial engineering.*
2. *To calculate the activity and project scheduling cost using PERT and CPM techniques*
3. *To perform an analysis for inventory and product quality control.*
4. *To understand the industrial legislation, design of plant layout and work study.*

COURSE CONTENTS:

Module-1. **Production, Planning and Control:** Definition and importance, types of production: job, batch & mass production, routing, scheduling, dispatching and follow up. Forecasting elements, time series, regression, causal and Delphi methods.Break even analysis and Gantt chart, Project scheduling, application of CPM and PERT techniques, Analysis and control of project cost in CPM and PERT, simple numerical problems.

Module-2. **Inventory Control:** Definition, types of inventory - Codification and standardization ABC analysis. Economic ordering quantity Procurement cost, carrying charges, lead-time, re-order point, simple problems. Definitions, types of inspection and procedure Statistical quality control - Basic theory of quality control, Process capability Control charts for variables - and R, relationship between control limits and specification limits. Control chart for fraction defective (p), control chart for number of defects

Module-3. **Job Evaluation and Wage Plans & Industrial Legislation**: Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans. Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, and Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, and Employees provident fund scheme.

Module-4. **Work Study:** Definition, advantages and procedure of work-study. Difference between production and productivity, Factors to improve productivity. Method Study: - Definition, objectives and procedure of method study. Symbols, flow process chart (man-machine and material), flow diagram, machine chart, two hand chart Critical examination. Developing a new method Principles of motion economy. Therblig symbols, SIMO chart simple problems. Work Measurement -time study, definition, principle and method of time study Stop watch study - number of reading, calculation of basic time, rating techniques, normal time, allowances, and standard time Simple numerical problems. Work Sampling - Definition, method, advantages and disadvantage of work sampling Applications.

Module-5. **Plant Location and Layout:** Definition, factors affecting the site selection of plant, Factor affecting plant layout. Types of layout: process, product, combination and fixed position layout Techniques in making layout-Flow diagram, templates, distance volume matrix, travel chart Line balancing, and workstation. Material Handling: Principles of economic material handling Hoisting equipment - forklift truck, Cranes- mobile motor cranes, overhead cranes, travelling bridges crane and Derrick crane. Whiler crane Conveying equipment - Package conveyors, gravity roller conveyors, screw conveyors, flight or scraper conveyors, bucket conveyors, bucket elevators, belt conveyors, and pneumatic conveyors.

REFERENCES:

1. SeetharamaL.Narasimhan, Dennis W.McLeavey, Peter J.Billington, "Production Planning And Inventory Control" , PHI, 2nd Edition, 2002.
2. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
3. Monks J.G, "Operations Management", McGraw Hill, 1997
4. Panneerselvam. R, Production and operations Management,PHI,2005
5. Lee J.Krajewski, Larry P.Ritzman, "Operations Management Strategy and Analysis", PHI, 6th Edition, 2003.
6. Kenneth R.Baker, "Introduction to Sequencing and Scheduling", John Wiley & Sons, New York, 2000.
7. Dilip R. Sule, "Industrial Scheduling", PWS Publishing company, Boston, 1997.

EVALUATION:

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

COURSE OUT COMES:

On the completion of this course, student will able to

CO1	Define basic concept of industrial engineering and their importance.
CO2	Discuss Various Inventory Control Models, plant layout, work study methods and Industrial Legislations.
CO3	Calculate the activity and project scheduling cost using PERT and CPM 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	3	-	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-

Jabalpur Engineering College, Jabalpur

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

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
5	AI601	PEC	Elective I	70	20	10	-	-	100	3	1	-	4
5	AI602	OEC	Elective II	70	20	10	-	-	100	3	-	-	3
1	AI603	PCC	Complier Design	70	20	10	30	20	150	3	-	2	4
3	AI604	PCC	Internet of Things(I.O.T)	70	20	10	30	20	150	3	-	2	4
2	AI605	PCC	Robotics Technology	70	20	10	30	20	150	3	-	2	4
6	AI606	PI	Minor Project-I	-	-	-	60	40	100	-	-	2	1
7	AI 607	MC	Industrial Training	Minimum Four Week Duration Industrial Training (with project Report) will be done at the end of 6 th semester. Evaluation of same will take place in 7th semester.									
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	AI608	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 courses in subject code AI608 for the award of Honours (Minor Specialization).									

Note: Departmental BOS will decide list of three elective subjects for each PEC/OEC (Program / Open Elective Course).

Professional Elective Courses I		
S.No	Subject Code	Subject Name
1	AI601A	Applications of AI
2	AI601B	Optimization Methods in AI
3	AI601C	Information Retrieval

Open Elective Courses II		
S.No.	Subject Code	Subject Name
1	AI602A	Economics & Social issues
2	AI602B	Software Engineering
3	AI602C	Quantum Computing

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

Permitted maximum 3 MOOC courses for the award of minor specilization degree.

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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					
AI601A	Applications of AI	70	20	10	30	20	100	3	1	-	4

Module-I: AI and Humanity:

Introduction to human and artificial intelligence, Introduction to AI and Ethics, Understanding Artificial Intelligence: History, definitions, and applications, Ethical considerations in AI, development and deployment, Impact of AI on society and the need for ethical frameworks. AI and Social Implications, AI and workforce:, Reskilling and upskilling, Privacy, Data collection and surveillance, Individual rights and consent, Privacy-preserving AI..

Model-II: Applications of AI in Healthcare:

Overview of AI in healthcare: definitions, trends, and applications, Ethical considerations and challenges in AI adoption in healthcare, Introduction to healthcare data and AI technologies. machine learning algorithms used in healthcare, Supervised and unsupervised learning techniques for medical data analysis, Deep learning approaches for medical image analysis. Applications of natural language processing (NLP) in healthcare, Text mining and information extraction from clinical documents. AI applications in medical imaging for diagnosis and analysis, Genomic data analysis and personalized medicine, Ethical considerations and challenges in AI-enabled medical imaging and genomics.

Module-III: AI in Cyber Security

Basic Concept of cyber security, layers of security, vulnerability threat, harmful acts, Internet Governance-Challenges and Constraints, overview of attackers motives, active attacks, passive attacks, Software and hardware attacks, Methods of defence, Security Models, risk management, Cyber Threats, Application of AI algorithms in the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and case study of the algorithms required and implementations of AI in cyber security, etc.

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Module-IV: AI In Surveillance:

Introduction to surveillance, overview of computer vision problems, various purposes- including tracking and monitoring, intelligent video analytics, Video Content Analytics (VCA), Surveillance Video Anomaly Detection, Radio-Frequency Identification (RFID), Adaptive Kalman Filter, Gaussian mixture model, Auto encoders AE, Recurrent Neural Network (RNN), Monte- Carlo Condensation Filters based techniques of tracking

Module-V: Application of AI in Agriculture

Crop yield predictions and price forecasts, Intelligent spraying, Disease diagnose, Crop and soil monitoring, Solar Refrigerators, Lifecycle of agriculture, Challenges faced in Agriculture with traditional farming techniques and brainstorming solutions using AI algorithm.

Recommended Books:

1"Artificial Intelligence in Healthcare" by Adam Bohr, Martin Homola, and Filip Železný (Oxford University Press)

2."Artificial Intelligence for Healthcare: Domain Adaptation, Transfer Learning, and Representation Learning" by Zachary C. Lipton, Alexandra Chouldechova, and Julian McAuley (MIT Press)

3"Machine Learning for Healthcare" by Ziad Obermeyer, Ezekiel J. Emanuel, and Isaac S. Kohane (Oxford University Press)

4."Clinical Decision Support Systems: Theory and Practice" by Eta S. Berner and Andrew S. Bindman (McGraw-Hill) "The Cambridge Handbook of Artificial Intelligence" edited by Keith Frankish and William M.

5Ramsey

6."The Ethics of Artificial Intelligence" edited by Nick Bostrom and Eliezer Yudkowsky

7.The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies" by

8.Erik Brynjolfsson and Andrew McAfee

9Human Compatible: Artificial Intelligence and the Problem of Control" by Stuart Russell

10."Natural Language Processing in Healthcare" by Wendy W. Chapman, Ozlem Uzuner, and Özlem Çetinoğlu (MIT Press)

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

CO1	Identifying and understanding AI applications techniques.
CO2	AI applications and implementations in Healthcare
CO3	Concept of Cyber security and its applied AI algorithms.
CO4	Design all kind of surveillance and computer vision AI algorithms
CO5	Analyze Empathy and problem design for regular problems in agriculture

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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					
AI601B	Optimization Methods in AI	70	20	10	30	20	100	3	1	-	4

Module I- Introduction to Optimization methods:
Need of optimization Methods, Classes of optimization problems, Problems solving using Graphs, Matrices, Optimization problems formulation in Machine Learning and Signal Processing.

Module II- Overview of applied modeling :

Basics of Linear Algebra and Calculus: Subspaces, EigenValue, Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus.

Module III- Linear and Integer Programming-
Introduction to linear programming, interger programming , related tricks , graphical methods of solving LP and IP.Solved problems on minimizing norms, max flow, solving IP using Branch & Bound and more examples on LP , IP formulations

Module VI Introduction to Optimization of Convex Function:

Introduction to Optimization, Convex Sets, Convex Functions, Lagrange Duality, Convex Optimization Algorithms, Second-order cone models, Semi-definite programming, Semi-infinite programming, Minimax, Sublinear algorithms, Interior Point Methods, Active set, Stochastic gradient, Coordinate descent, Cutting planes method, Applications to Image/Video/Multimedia Processing

Module V Optimization in Machine Learning:

Theory of Gradient Discent & Stochastic ,training a neural network, Newton Method for optimization, Pytorch – Tensor Flow Trainning a neural network & implementation.

Books:
1.Convex optimization by Stephen Boid
2. Optimization for machine learning by Suvrit Sra , MIT Press
3. Linear Algebra and Learning from Data, Gilbert Strang

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Course outcomes:

After completion of course, student will be able to:

CO1	Identifying and understanding Al Optimizing techniques.
CO2	Develop mathematical modeling and applications.
CO3	Understand the design algorithms for linear systems
CO4	Learn Concept of Convex optimization and its application
CO5	Design optimization in Machine learning algorithms

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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					
AI601C	Information Retrieval	70	20	10	30	20	100	3	1	-	4

Module-I: INTRODUCTION:
Introduction. History of IR. Components of IR, Issues. Open source Search engine Frameworks. The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus, Web Search. Components of a Search engine, Characterizing the web.

Module-II: INFORMATION RETRIEVAL:
Boolean and vector space retrieval models. Term weighting. TF-IDF, weighting- cosine similarity, Preprocessing, Inverted indices, efficient processing with sparse vectors. Language Model based IR. Probabilistic IR, Latent Semantic Indexing - Relevance feedback and query expansion.

Module-III: WEB SEARCH ENGINE - INTRODUCTION AND CRAWLING:
Web search overview, web structure, paid placement, search engine optimization/ spam. Web size measurement, Web Search Architectures, crawling, meta-crawlers, Focused Crawling, web indexes, Near- duplicate detection, Index Compression, XML retrieval.

Module-IV: WEB SEARCH - LINK ANALYSIS AND SPECIALIZED SEARCH:
Link Analysis. hubs and authorities, Page Rank and HITS algorithms, Searching and Ranking, Relevance Scoring and ranking for Web, Similarity. Hadoop & Map Reduce Evaluation, Personalized search, Collaborative filtering and content-based recommendation of documents and products, "handling "invisible" Web. Snippet generation, Summarization, Question Answering. Cross- Lingual Retrieval.

Module-V: DOCUMENT TEXT MINING:
Information filtering, organization and relevance feedback. Text Mining. Text classification and clustering, Categorization algorithms: naive Bayes; decision trees; and nearest neighbor, Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Books:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press. 2. Ricardo Barza - Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition. ACM Press Books,
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, Ist Edition Addison Wesley.
4. Mark Levene. An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley.

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

CO1	Apply information retrieval models.
CO2	Design Web Search Engine.
CO3	Use Link Analysis.
CO4	Apply document text mining techniques.
CO5	Apply document text mining techniques.

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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					
AI602 A	Economics & Social Issues	70	20	10	30	20	100	3	-	-	3

Module -I Indian Economy on the eve of independence. British Rule and its impact on economy, Population growth its pattern, genders. rural urban literacy, Poverty and inequality agriculture and its productivity Green Revolution. Industrial economy pattern, small scale industries.

Module -II Micro economics. Theory of consumer behavior, Law of diminishing utility, demand and supply. Demand curve. elasticity of demand. Theory of production, Theory of cast.

Module -III National income. Measurement of national income. Measurement of cost of living. Consumption function. investment function. Economics fluctuations GDP, GVP.

Module -IV Concept of public and private goods public budget, optimum budget, plan budget, budget procedure of India. Taxes in India.

Module-V Indian economy policy, population policy anti-poverty programmes, NRECA Risht to employment, MSME, growth, structure EXIM policies.

Books

1.Mishra & Puri Indian Economics
2. Rana & Verma Macro economics
3. Navendra Jadhav. Monetary Policy
4. J. Ray Chellaih. Trends and Issues in Indian Finance

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

CO1	Understanding Indian Economy since independence
CO2	General information about micro Economics, Demand supply Losses
CO3	Compressive Knowledge about GDP and GNP, consumption
CO4	Compressive study of private public systems functioning and taxation systems
CO5	Knowledge about polices of Indian Economy and MSME

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI602 B	Software Engineering	70	20	10	30	20	100	3	-	-	3

Module I: Introduction:

Phases in Software development, Software Development Life Cycle (SDLC), software development process models Software process models (Linear Sequential Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, and Rational Unified Process), Agile process.

Module II: Software Requirement specification (SRS):

Role of SRS, Requirements gathering and problem analysis, requirement specification, validation of SRS document. Use cases: Use case modelling, Use case diagram and use case documents/specifications.

Module III: Object-Oriented Modeling (using UML):

Analysis Modeling, Developing Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram. System and Subsystem Design, Design goals, Design Patterns.

Module IV: Software Testing:

Unit testing, Integration testing, System testing, Regression testing, Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis.

Module V: Software Project Management:

Software Project Planning, Cost Estimation, Scheduling, Risk Management, Quality Management, Software Change Management, Software Configuration Management, Re-engineering, Reverse Engineering, Project Plan

Suggested books:

1. RS. Pressman,"Software Engineering: A Practitioner's Approach", McGraw-Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning.
3. Sommerville,"Software Enginerring", Pearson Education.
4. Grady Booch, Robart A. Maksimchuk, Michael W. Engle, Bobbij Young, Jim Conallen, and Kellia Houston, "Object Oriented Analysis & Design with Applications", Pearson Education India.

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5. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa.
6. Bernd Bruegge, Allen Dutoit: "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Prentice Hall.
7. Blaha and Rumbaugh. "Object-Oriented Analysis and Modeling using UML",TMH.

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

CO 1	Explain concepts of software engineering such as SDLC and software process models, SRS, UML models (or Software Artefacts), software testing and software project management.
CO 2	Analyze SRS/problem specifications to extract relevant domain elements such as domain class, class attributes, operations and relationships between classes.
CO 3	Develop the use case models, analysis level class diagram and sequence diagrams for the given Problem.
CO 4	UML models such as Class Diagram, Sequence Diagram. Class Collaboration Diagram, Activity Diagram, State Transition Diagram and test cases for a given software problem.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI602C	Quantum Computing	70	20	10	30	20	100	3	-	-	3

Module-I: Introduction

Introduction to quantum computing, fundamental concepts,Global perspectives, quantum Bits, Computation, quantum Algorithm, Quantum Information, Assignment on experimental quantum information processing.

Module-II Quantum Algorithms

Superdense coding, quantum teleportation,applications of teleportation, probabilistic versus quantum algorithms, phase kick-back, the Deutsch Algorithm, simon.s algorithm. Problem solving assignment for algorithms,

Module-III: Quantum Computations

Quantum circuits, Algorithm, circuit model of computation and simulation, quantum Fourier Transform and applications, search algorithm. Assignment and tutorials based on quantum fourier transform and quantum search algorithm.

Module-IV: Quantum Estimation
Quantum algorithm for Order-finding problem, Eigen value Estimation,finding discrete algorithm hidden subgroups, search algorithm amplitude estimation,algorithms without knowing the success probability.

Module-V: Quantum Information Theory

Quantum states and accessible information, Data compression, classical information over Noisy quantum channels, quantum box model, error correction and fault tolerant computations. Quantum cryptography. Assignment for quantum compression and noisy channels, problem solving exercises.

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Books-

1. V. Sahni, Quantum Computing, Tata Mcgra-Hill publication,2007
2. P. Kaye, R. Laflamme and M. Mosca, " An introduction to Quantum Computing", Oxford University press 1999.
3. Scott Aarnson, " Quantum Computing Since Democritus", Cambridge University press, 2013
4. Research papers review.

Course Outcomes:

After successful completion of the course, the students will be able to:

CO1	Knowledge of basics of Quantum Computing
CO2	Learn computation techniques and algorithms
CO3	Analyze and design the estimation and error correction algorithms

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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					
AI603	Compiler Design	70	20	10	30	20	150	3	-	2	4

Module-1: Introduction: Compilers and Translators: The phases of the compiler - Lexical Analysis. Syntax Analysis, Intermediate Code Generation. Optimization, Code generation, Bookkeeping, Error handling.

Module-II: Lexical Analysis: The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata: Regular expressions, NFA, DFA. Design of a lexical analyzer generator.

Module-III: **Syntax Analysis**: The role of a parser, Context free grammars, writing a grammar, Top down Parsing: Recursive decent parser, Predictive parser. Bottom up Parsing: Handles. Viable prefixes, Operator precedence parsing. LR parsers: SLR, LALR, CLR. Parser generator (YACC).Error Recovery techniques for different parsers. **Syntax directed translation:** Syntax directed definitions, Synthesized and inherited attributes, Construction of syntax trees.

Module-IV: Run time environments: Source language issues (Activation trees, Control stack, scope of declaration, binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies. Symbol tables: storage, data structures used.

Module-V: Intermediate code generation: Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples). Code optimization and **code** generation: Introduction. Basic blocks & flow graphs, DAG, principle sources of optimization: loop optimization, eliminating induction variable, eliminating common sub-expression, loop unrolling, loop jamming etc. Peephole optimization, Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Book:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network. Defense". Second Edition, CENGAGE Learning
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools!, Second Edition. Pearson Education
3. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach,

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Morgan Kaufmann Publishers.
4. Steven S. Muchnick, Advanced Compiler Design and Implementationl, Morgan Kaufmann Publishers Elsevier Science, India, Indian Reprint.
5. Keith D Cooper and Linda Torczon, Engineering aCompiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
6. V. Raghavan, Principles of Compiler Design, TataMcGraw Hill Education Publishers.

Course outcomes:

After completion of course, student will be able to:

CO1	Understand fundamentals of the compiler and identify the relationships among different phases of the complier
CO2	Understand the application of finite state machines, recursive descent, production rules parsing, and language semantics.
CO3	Analyze & implement required optimizations modules and apply for various optimization techniques for dataflow analysis.
CO4	Use modern tools and technologies for designing new compilers

List of Experiments AI601L

1. Write a program to identify. Whether a given line is a comment or not.
2. Write a C program to recognize strings "a", a* b + ; abb
3. Write a C program to test whether a given identifier is valid or not
4. Write a c program to simulate lexical analyzer for validating operators.
5. Implement the lexical analyzer using 3 Lex, flex or other lexical analyzer generating tools.
6. Write a c programs for implementing the functionalities of predictive parser for the mini language.
7. Write a Program "C" program to implement LALR parsing
8. Write a program to check whether a string to the grammar or not.
9. Write a program to find the numbers of Whitespaces and new line characters.
10. Write a program to find loading terminal

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI604	Internet of Things	70	20	10	30	20	150	3	-	2	4

Module I: **IoT Introduction and Fundamentals**: Deciphering the term IoT, Applications where IoT can be deployed, Benefits/challenges of deploying an IoT, IoT components: Sensors, front-end electronics (amplifiers, filtering, digitization), digital signal processing, data transmission, choice of channel (wired/wireless), back-end data analysis. Understanding packaging and power constraints for IoT implementation

Module II: Signals, Sensors, Actuators, Interfaces: Sensors: types, signal types, shape and strength, Sensor non-idealities: Sensitivity and offset drift, noise, minimum detectable signal, nonlinearity, Read-out circuits: Instrumentation-amplifier, SNR definition, noise-bandwidth-power trade off, Circuit component mismatch and mitigation techniques (calibration, chopping, auto zeroing etc.), Power/energy considerations, Basic signal processing (filtering, quantization, computation, storage),

Module III: Networking in IoT: Review of Communication Networks, Challenges in Networking of IoT Nodes, range, bandwidth, Machine-to-Machine (M2M) and IoT Technology Fundamentals, Medium Access Control(MAC) Protocols for M2M Communications, Standards for the IoT, Basics of 5G Cellular Networks and 5G IoT Communications, Low-Power Wide Area Networks (LPWAN), Wireless communication for IoT: channel models, power budgets, data rates, IoT Security and Privacy, MQTT Protocol, Publisher and Subscriber Model

Module IV: Cloud Computing in IoT
Cloud computing platform (open source) and local setup of such environment, embedded software relevant to microcontroller and IoT platforms (enterprise or consumer), user interfaces

Module V: Data Analysis for IoT applications
Statistics relevant to large data, linear regression, Basics of clustering, classification.

BOOKS:

1. Introduction to IOT By Sudip Mishra, Aandarup Mukherjee, Arijit Roy & Kamal Kant Hiran.
2. Coco Blue / Amazon / IOT Ahandson approach By Arshdeep Bahga & Vijay Madisetti.
3. 21 IOT Experiments By Yashwan kanedkar & Shrirang Korde, BPB Publication India.
4. IOT By Er. Vk Jain, Khanna Publisher.

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

CO1	Understand the fundamentals of Internet of things
CO2	Knowledge of interfacing of signal, sensors and actuators in Internet of Things
CO3	Interpret networking in Internet of things
CO4	Implement on Cloud computing in Internet of things
CO5	Analyze the data for various Internet of things applications

List of Experiment:-AI604L

1. Sense the available Networks using arduino.
2. Measuring the distance using ultrasonic Sensor and make led Blink using arduino.
3. Detect the vibration of an object using arduino.
4. Connect with the available Wifi using arduino.
5. Sense a finger when it is placed On Board using arduino.
6. Temperature notification using auduino.
7. LDR to vary the light intensity of LED using Arduino.
8. Switch light on and off Based on the User using Respberry Pi.
9. Application of circuit design using Respberry Pi 3& 4.
10. Study & application of thermal camera & circuit design,
11. AI based audio control operations.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Mst	Quiz, Assignment	End Sem	Lab Work					
AI605	Robotics Technology	70	20	10	30	20	150	3	-	2	4

Module I: Introduction:
Classification of Robots, Basic Robot Components, Manipulator End Effectors, Controller, Power Unit, Sensing Devices, Specification of Robot System, Accuracy Precision and Repeatability. Coordinate Systems: Cartesian Coordinates, Transformation Matrices, Reference Frame Transformations, Orientation, Inverse Transformations, and Graphs.

Module II: **Robotic Sensing Devices:**
Position, Velocity and Acceleration Sensors, Proximity and Range Sensors, Touch and Slip Sensors, Tectile Sensors, Force and Torque Sensors. Robotic Vision System: Imaging Components Picture Coding, Object Recognition, Training **and** Vision Systems, Review of Existing System.

Module III: Robotics Programming:
Methods of Robotics Programming, Types of Programming, Robotics Programming Language, Artificial Intelligence. Robot Application: Material Transfer and Machine Loading Unloading, Processing Applications, Welding and Painting Assembly and Inspection, Future Robotic Application and Related Technologies Development.

Module IV: Image Identification:
Lenses, Videocon Tube, Solid-State Vision System, Image Process Binary Image Analysis Identification, The Transformation. Actuators and Power Transmission Devices: Pneumatic and Hydraulic Actuators, Electrical Actuators, Power Transmission Trajectory Planning & Control: Manipulator Equations of Motion Manipulator Control, The Measure of the Robot.

Module V: Control:
Basic Concepts in Control Systems, Digital Control for Positions. System Integration: Mechanism, Actuators and Sensors.

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Books:

1. J.craig, "Introduction to Robotics" Addision Wesley.
2. Klafter, chemielwski and nagrin, "Robotics Engineering", Prentice hall.
3. Robert J. Schiling, "Fundamental of Robotics analysis and control", Pearson education.
4. K. S. Fu, R.c. Gonzalez, C.S.g lee, "Robotics" TMH.
5 Robotics Technology Khanna Publishers,2021.

Course outcomes:

After completion of course, student will be able to:

CO1	Define various fundamental concepts of robotics such as robot and its components, co-ordinate system, robotic sensing, image identification, 'vision system, control system, robot programming and applications.
CO2	Classify and compare various sensors, sensing devices, robot programming methods, transmission devices and control systems.
CO3	Experiment with programming samples, control rules and parameters with available hardware and software.
CO4	Evaluate mathematic and programming problems of various robotic concepts.

List of Experiment: AI602L

1. Demonstration of Cartesian / cylindrical/spherical robot.
2. Demonstration of articulated /SCARA robot
3. Design modeling and analysis of two different types of gripper
4. Study of Robotic system design.
5. Robot programing and simulation for pick place
6. Robot programing and simulation for color identification.
7 Robot programing & simulation for cutting and welding
8. Robot programing & Simulation for microsprocess.

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(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI 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						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	MT601	PEC	Professional Elective I	70	20	10	-	-	100	3	1	-	4
2	MT602	OEC	Open Elective II	70	20	10	-	-	100	3	-	-	3
3	MT603	PCC	Fluid Mechanics and Heat Transfer	70	20	10	30	20	150	3	-	2	4
4	MT604	PCC	Data Communication & Computer Network	70	20	10	30	20	150	3	-	2	4
5	MT605	PCC	Robotics & Automation	70	20	10	30	20	150	3	-	2	4
6	MT606	PI	Minor Project	-	-	-	60	40	100	-	-	2	1
7	MT607	MC	Industrial Training	Minimum Four Weeks Duration (With Project Report). Evaluation will be done in 7th semester									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	**1**	**8**	**20**
8	MT608	DLC	SWAYAM/MOOC/NPTEL	-	-	-	-	-	-	-	-	-	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 MT608 for the award of Honours (Minor Specialization).									

Note: 1 Departmental BOS will decide list of three optional subjects those are available in MOOC as well for PEC.

2 Summer Industrial training should be apart from laboratory work undertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be submitted at the beginning of 7th semester and students have to give a presentation in the departement. Evaluation will be done in 7th semester.

Professional Elective-I

S.No.	Subject Code	Subject Name
1	MT601 A	EV & HV Technology
2	MT601 B	Dyanamics of Machinery
3	MT601 C	Power Plant Engineering

Open Elective-II

S.No.	Subject Code	Subject Name
1	MT602 A	Mechatronics Systems Design
2	MT602 B	Industrial Engg
3	MT602 C	Power Electronics

PEC: Professional Elective (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC/PI: Digital Learning 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

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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-601 (A)	EV and HV Technology	70	20	10	-	-	100	3	1	-	4

Module I. Introduction to Electric Vehicle:

History of Electric Vehicles, Development towards the 21st Century, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Motion and Dynamic Equations of the Electric Vehicles: various forces acting on the Vehicle in static and dynamic conditions. 4

Module II. Induction to Hybrid Electric Vehicle:

Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid Drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. 4

Module III. Electric Drive Trains:

Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. 10

Module IV. Types of Storage Systems:

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Calculation for the ratings.

Module V. Modelling of Hybrid Electric Vehicle Range:

Driving Cycles, Types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Case study of 2 wheeler, 3 wheeler and 4 wheeler vehicles

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Reference Books:

1. James Larminie, J. Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd. 2003.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
3. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies",Springer, 2015.
4. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003

Course Outcomes:

After completing the course, students will be able to:

CO1	Select appropriate source of energy for the hybrid electric vehicle based on driving cycle.
CO2	Analyze the power and energy needs of the various hybrid electric vehicle.
CO3	Measure and Estimate the energy consumption of the Hybrid Vehicles.
CO4	Evaluate energy efficiency of the vehicle for its drive trains.

List of Open Source Software/learning website:

- Online course: https://nptel.ac.in/course.html
- Ocw.mit.edu/courses
- https://www.eng.mcmaster.ca/mech/content/electric-and-hybrid-vehicles

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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-601 (B)	DYNAMICS OF MACHINERY	70	20	10	-	-	100	3	1	-	4

Module-I. 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-II. Governor Mechanisms: 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-III Balancing of Inertia Forces and Moments in Machines: Balancing of rotating masses, two plane determination of balancing masses (graphical and analytical methods), balancing of rotor:

Module-IV. 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-V. Brakes: Band brake, block brakes, Internal expanding shoe brakes.
Dynamometer: Different types and their applications.

Books:

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; Thcory of Machine
5. Ghosh and Ma!!ik; Thecry of Mechanisms and Machines; Affiliated Fast-Wes. 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.

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COURSE OUTCOMES: At the end of the course the student will 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.

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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					
MT601 (C)	Power Plant Engineering	70	20	10	-	-	100	3	1	-	4

Module I: Renewable Energy Power Plants:

Introduction to methods of converting various energy sources of electric power, direct conversion methods renewable energy sources, solar, wind, tidal, geothermal, bio-thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter.

Module II: Fossil Fuel Steam Stations:

Fossil Fuel Steam Stations: Basic principles of station design, recent trends in turbine and boiler sizes and steam conditions, plant design and layout, outdoor and indoor plant, system components, fuel handling, burning systems, feed water treatment plant, condensing plant and circulating water systems, cooling towers, turbine room and auxiliary plant equipment., instrumentation, testing and plant heat balance. Combined cycle power generation, heat recovery steam generator, co-generation plant.

Module III: Nuclear Power Station:

Nuclear Power Station: Importance of nuclear power development in the world and Indian context, Review of atomic structure and radio activity, binding energy concept, fission and fusion reaction, fissionable and fertile materials, thermal neutron fission, important nuclear fuels. moderators and coolants. Types of reactors, pressurized water reactor, boiling water reactor., breader reactor , CANDU reactor, gascooled reactor,

Module IV: Hydro-Power Station:

Classification on of hydroelectric power plant, introduction to hydrology, Plant layout, hydro plant auxiliaries, cost of plant, life of plant, hydro power control, electrical and mechanical components, comparison of hydro power station with thermal power station, automatic and remote control of power plant, safety measures and preventive maintenance of hydro power plant, calculation of available hydro power.

Module V: Power Station Economics:

Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor and their influence on plant design, operation and economics; comparison of hydro and nuclear power plants typical cost structures, simple problems on cost analysis, economic performance and tariffs, interconnected system and their advantages, elements of load dispatch in interconnected systems.

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References:

1. Nag PK; Power plant Engg; TMH
2. Al-Wakil MM; Power plant Technology; TMH
3. Sharma C: Power plant Engg: Kataria and sons, Delhi
4. Donkundwar: Power Plant Engg, Dhanpatraic sons.
5. Rajput RK, A text book ot Power plant Engg.,Laxmi Publications.
6. Yadav R, Steam and gas turbine and power plant engg by

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

CO1	Define the procedure of site selection for power plant and able to know the procedure to convert renewable, fossil fuel energy, nuclear energy & fluid energy in to electric power
CO2	Explain function of different mechanism of power plant like fuel handling, its combustion, Utilization of potential of energy to convert in power by using mechanical and electrical equipments.
CO3	To draw the layout of power plant like renewable energy based, fossil fuel based, hydro and nuclear based power plants
CO4	Estimate the power plant load, maximum demand, load factors, diversity factor, plant factor and their influence on plant design, operation and economics.

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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-602 (A)	Mechatronics System Design	70	20	10	-	-	100	3	-	-	3

Module I Introduction to Mechatronics System Design:

Introduction to Mechatronics system, Elements of Mechatronics system: Sensor, actuator, plant, and controller, Applications of Mechatronics system, Systems like CDROM and scanner: exploration of internal components and their functionality.

Module II: Integrated Mechanical-Electronics Design

Integrated mechanical-electronics design philosophy, Examples of real-life Mechatronics systems, Smart sensor concept, Utility of compliant mechanisms in Mechatronics. Combinational sequential logics, ASM and FSM.

Module III: Microcontrollers for Mechatronics and Mathematical Modeling:

Microcontrollers for Mechatronics, Philosophy of programming interfaces, Setting sampling time, Getting started with TIVA programming, Microcontroller programming philosophy with emphasis on TIVA, Programming different interfaces like PWM, QEI, etc., Mathematical modelling of Mechatronics systems, Modelling friction, DC motor, Lagrange formulation for system dynamics.

Module IV: Control Systems in Mechatronics:

Dynamics of a 2R manipulator, Simulation using MAT lab, Selection of sensors and actuators, Concept of feedback and closed-loop control, Mathematical representations of systems, Control design in the linear domain, Basics of Lyapunov theory for nonlinear control, Notions of stability, Lyapunov theorems and their application, Trajectory tracking control development based on Lyapunov theory.

Module V: Communication systems and Practical Implementations:

Modulation techniques –AM,FM, sampling , PCM, PAM,PPM,PWM systems and Basic modulators and demodulators for Mechatronics system implementation, Research examples/case studies of the development of Mechatronics systems

References:

1.Mechatronics Systems Design and Solid Materials by Satya Bir Singh (Editor); Prabhat Ranjan (Editor); Alexander V. Vakhrushev (Editor); A. K. Haghi (Editor)

2.The Design of High Performance Mechatronics - 3rd Revised Edition by R. Munnig Schmidt; G. Schitter; A. Rankers

3.Mechatronics System Design, Devdas Shetty, Richard A. Kolk, Cengage Learning, 2010

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4. communication systems, Dr Singh and Sapre, Tata Mcgrauhills

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

CO1	Understand mechatronics system elements and their interplay.
CO2	Apply integrated mechanical-electronics design to real-life systems.
CO3	Program microcontrollers (TIVA) for control and signal processing.
CO4	Master mathematical modeling for friction, DC motors, and system dynamics.
CO5	Gain expertise in control systems, feedback, linear control design, and Lyapunov theory.

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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-602 (B)	Indutrial Engineering	70	20	10	-	-	100	3	-	-	3

Module I: Reliability Engineering: Introduction and objectives of Reliability Engineering, System Reliability, Achieving Reliability, Failure Rate, Hazard Rate, Failure Modes and the 'Bath tub'curve, Series Structure, Parallel Structure, Combination Structure, Design , Important Aspect of Reliability, Maintainability, Availability, Improving Reliability.

Module II: Capacity Planning: Measurement of Capacity, Estimating Future capacity, Factors influencing effective capacity, Factors Favouring over capacity and under capacity, Business Process Reengineering, Definition, Characteristics of BPR, Need for Re-engineering, Steps in Reengineering, Process of Re-engineering, Industrial Engineering and Re-engineering, Success factors in reengineering, Advantages of Re-engineering.

Module III: Sequencing Models: Introduction, Assumptions, Gantt chart for Solving Sequencing Problems, Processing n jobs through 2 machines, Johnsons Algorithm, Loading, Sequencing and Scheduling, Visual load Profile, Priority Sequencing, Assignment Problems, Principles of scheduling, Inputs to scheduling, Scheduling strategies, Forward scheduling and backward scheduling, Finite Loading, Critical ratio loading, Index method.

Module IV: Marketing Management: Marketing Function, Marketing Management Process and Marketing Planning, Market Research, Consumer Behaviour, Product Life Cycle, Product, Product Lines and Brands, Physical Distribution Channels, Sales Promotion & advertising programs.

Module V: Human Resource Management: Definition, Objective of Human Resource Management, Characteristics, Functions/Scope, Principles of Human Resource Management, and Manpower Planning - factors Affecting Manpower Planning, Steps in Manpower Planning, recruitment and Selection procedure of Manpower. Training and Development of Manpower: Need of Training, Benefits of Training, Method of Training Workers, Foreman or Supervisory Training, Executive/IV1anagers Training and Development, learning curves and classifications.

References:

l. Khanna O. P., "Industrial Engineering and Management", Dhanpat Rai and sons, 2007. 2.BangaT. R. and Sharma S. C., "Industrial Organization & Engineering economics",23ed., Khanna Publishers, 2001.
3. Mahajan M., "Industrial Engineering and Production Management" Dhanpat rai and Sons Publishers,2005.

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

CO1	Understand about What is Reliability and how to allocate Reliability to each component.
CO2	Apply core concepts of Capacity Planning
CO3	Solve sequencing problem
CO4	Understand Marketing Function, market dynamics, demands, and environment. Marketing Management Process
CO5	Understand Principles of Human Resource Management

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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-602 (C)	Power Electronics	70	20	10	-	-	100	3	-	-	3

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, 1 993.

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2. M.Ramsmoorthy, "An Introduction to transistor their Applications", affiliated East-West Press.
3. P.C.Sen "Power Electronics", TMH publication.
4, MD.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 2006.
8. Randal Shaffer, "Fundamental of Power Electronics with MATLAB learning" 2008.

COURSE OUTCOMES: At the end of the course the student 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.

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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 603	Fluid Mechanics & Heat Transfer	70	20	10	30	20	150	3	-	2	4

Module I: Fluid Statics: Basic concepts &properties of the fluid. Newton's law of viscosity, types of fluids ,Pressure measurement by manometers and gauges. pressure variation in static fluid, Absolute and gauge pressure, total force add centre of pressure, hydraulic forces on submersed surfaces - plan, inclined and curved surfaces; buoyancy, meta-center , Stability of floating and submerged bodies, Relative equilibrium.

Module II: Kinematics of Flow : Types of flow-ideal & real , Lagrange and Eulerian methods of study of fluid, steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & ir-rotational flow, velocity potential; stream function, flow net & its applications.

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor.

Module III: Flow through Pipes: Reynolds experiment & Reynolds number, laminar & turbulent flow, Introduction to Navier Stoke's Equation, relation between shear & pressure gradient, laminar flow through circular pipes, friction factor, laminar flow between parallel plates, flow through pipes in series and parallel, different types of head losses, friction factor and pressure drop.

Module IV: Conduction Heat Transfer

Heat transfer phenomena-thermodynamics & heat transfer. Heat conduction – Fourier's equation –steady state conduction in plexor and radial systems – Resistance concept – series and resistance in conduction – and parallel resistance in conduction – unsteady state conduction – lumped capacity model – extended surfaces (Feris) –combined conduction & convection – 2 dimensional conduction.

Module V: Convection Heat Transfer

Forced and natural convection – Dimensional analysis & numbers, Convection heat transfer coefficient, Correlations for flow over plate, through tubes, over spheres and cylinders, Agitated systems, Packed

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columns, condensation phenomena, Film and drop wise condensation over tubes. heat transfer coefficient. Introduction Radiation heat transfer and Energy of radiation. Radiation exchange between surfaces – black, gray bodies, view factors-sample problems.

REFERENCES:

1. R.K. Bansal A Textbook of Fluid Mechanics, Laxmi Publications; Second edition, 2020.
2. Heat & Mass Transfer by P. K. Nag, Tata McGraw Hill – IIIrd Edition 2003
3. K.A.Gavhane, Fluid flow Operations,Nirali publishers,1st Edition,2018.
4. R.K.Rajput A text Book of Heat & Mass Transfer SI Units , S.Chand publisher,2018.
5. Geankoplis. C.J "Transport Process & separation Process Principles" IVth Edition Prentice Hall of India 2013.

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

CO1	Understand the basic knowledge of Dimensional analysis & agitation process of Current Biotech Industries.
CO2	Acquire knowledge on the steady, unsteady and combined resistances of conduction and convection
CO3	Learn fundamentals of three heat transfer modes, and have hands-on experience on heat transfer equipment.
CO4	Familiar with radiation, boiling and condensation process of heat transfer.
CO5	Understand the basics of major heat and mass transfer operations

List of Experiments: MT603L

1.Viscosity Measurement: Measure flow rate through a capillary tube to determine fluid viscosity.
2.Bernoulli's Principle Verification: Verify energy conservation using pressure measurements along a flow apparatus with varying sections.
3.Composite Wall Heat Conduction: Measure temperatures across a composite wall to analyze heat conduction.
4.Forced Convection Heat Transfer: Measure temperature difference at different air velocities to determine convective heat transfer coefficient.
5.Radiation Heat Transfer: Measure temperatures of plates and heat source to analyze heat transfer by radiation.
6.Buoyancy and Stability: Analyze submerged surfaces to study buoyancy and stability characteristics.
7.Orifice Flow Measurement: Measure pressure drop across an orifice plate to determine flow rate in a pipe 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					
MT-604	Data Communication & Computer Network	70	20	10	30	20	150	3	-	2	4

Module I. Fundamentals Of Data Communication And Computer Network: Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol. Protocols, Standards, Standard organizations. Bandwidth, Data Transmission Rate, Baud Rate and Bits per second. Concept of Analog Signal and Digital Signal, Analog and Digital transmission: Analog To Digital, Digital To Analog Conversion,

Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits. Classification Of Network: LAN, WAN, MAN 7 Network Architecture: Peer To Peer, Client Server Network

Module II. Transmission Media and Switching:Communication Media: Guided Transmission Media, Twisted-Pair Cable, Coaxial Cable Fiber-Optic Cable, Unguided Transmission Media, Radio Waves, Microwaves, Infrared, Satellite, Line-of-Sight Transmission Point to Point, Broadcast, Multiplexing: Frequency-Division Multiplexing Time -Division, Multiplexing Switching: Circuit-switched networks, Packet -switched networks

Module III. Error Detection, Correction and Wireless Communication: Types of Errors: Single Bit Error and Burst Error, Redundancy, Error Detection: Longitudinal Redundancy Check (LRC), Vertical Redundancy Check(VRC), Cyclic Redundancy Check(CRC)Forward 3.3 Error Correction: Forward error Correction, Understanding about IEEE standards: 802.1, 802.2, 802.3, 802.4, 802.5 Wireless LANS: 802.11 Architecture, MAC Sublayer, Addressing Mechanism, Bluetooth Architecture: Piconet, Scatternet Introduction to Mobile Generations:1G, 2G, 3G, 4G and 5G, 6G.

Module IV. Network Topologies And Network Devices: Network Topologies: Introduction, Definition, Selection, Criteria, Types of Topology- i) Bus ii) Ring iii) Star iv) Mesh v)Tree vi)Hybrid. Network Connecting Devices: Hub, Switch, Router, Repeater, Bridge, Gateway, Modem, Wireless infrastructure Components.

Module V. Reference Models: OSI Reference Model: Layered Architecture, Peer-to-Peer Processes-Interfaces between Layer. Protocols, Organization of the Layers. Encapsulation Layers of the OSI Reference Model (Functions and features of each Layer) -- Physical Layer, Data-Link Layer, Network Layer, Transport Layer. Session Layer, Presentation Layer, Application Layer. TCP/IP Model: Layered ArchOARD C Introduction Addressing mechanism in the Internet IP Addressing - IP Address classes, classless IP addressing. Subnetting, supernetting, Masking, 5.4 IPv4 and IPv6. OSI and TCP/IP Network Model.

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References:

1. Data communications and networking, Forouzan Behrouz A.,Tata McGraw Hill, New Delhi, 2006.
2. Computer Networks, Tanenbaum Andrew S., PHI Learning Pvt Ltd, Delhi.
3. Data Communication and Networks, Godbole Achyut, Tata McGraw Hill, New Delhi, 2006.
4. Internetworking with TCP/IP Principles, Protocols and Architectures,Comer Douglas, PHI Learning Pvt Ltd, Delhi
5. Computer Networking,T. M. Bansod

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

CO1	Analyze the functioning of data communication and computer network.
CO2	Select relevant transmission media and switching techniques as per need.
CO3	Analyse the transmission errors with respect to IEEE standards
CO4	Configure various networking devices.
CO5	Configure different TCP/IP services.

List of Experiments: MT604L

1. Configure Peer-to-Peer Network with at least three hosts
2. Create desired standard network cable including cross cable and test by using cable Tester
3. Connect Computers using given topology with wired media
4. Connect Computers using wireless media.
5. Write a C program for CRC Error Detection.
6. Create a Network Using Bluetooth-(Piconet/Scatternet)
7. Share Printer and Folder in a network and transfer a file from one computer to another.

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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-605	Robotics and Automation	70	20	10	30	20	150	3	-	2	4

Module I. Introduction :

Definition, structure, classification , specification of robots, Industrial robots, Robot elements & controls like manipulators, drives,sensors, force/torque,trajectory planning , position control , Digital control & Feedback System.

Module II. Robot Modelling:

Coordinate, Frames, Mapping&Trasfermation, Review of Robot Kinematics: Joint/Task space, Forward Kinematics, Inverse Kinematics, Jacobians and Trajectory Generation, Robot Dynamics: Lagrange-Euler Dynamics, Force, Inertia, and Energy, Formulation of robot dynamics and State-Variable Representations,

Module III. Manipulator Dynamics:

Robot Control Problems: Regulator problem, tracking problem, controllers, Lyapunov Stability Theorem, Robust control and Feedback-Linearization Controllers, mass distribution, Control law partitioning trajectory following controls, Hybrid positioning/Force Controls, Variable-Structure Controllers and Saturation-Type Controllers ,manipulators, differential motion, static analysis, manipulator dynamics.

Module IV. Image Processing and Robotics Vision:

Image aquatition , Digital Image Formation, Image Processing Edge, Blobs, Corner Detection , Region of Interest, Feature Detection algorithm , Geometric Transformation , Application of Images Processing in Robotics.

Module V. Robot Programming:

Robot Integration , wheeled locomotion , path planning algorithms , graph search A* algorithm , Introduction to Artificial Neural network , Back propogation algorithm, Convolution neural network & CNN architechture , Introduction to deep learning & multilayer perceptron & CNN application in Object Detection &Image segmentation.

References:

1.Adrian Rosebrock, Deep Learning for Computer vision with Python- Practitioner Bundle, Pyimagesearch, 2017.
2.R.K Mittal & I.J. Naghrath Robotics & Control , NewDelhi 2003.

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3.Merzouki R. , Samantaray A. K. , Pathak P.M. , Bouamama B.ould, Intelligent Mechatronics system modelling control and diagnosis springer 2013.
4.K.C jain , P.L Verma , Rajesh Khodre , Introduction to Robotics , Khanna publication.
5.Neeraj Tiwari , Prashant Shrivastava , Abhishek Pandey , Artificial Intelligence for Engineers , Khanna Publication.
6. Niku Saeed B. Introduction to Robotics; Analysis , System , Application , PHI NewDelhi 2001.

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

CO1	Knowledge of robot technology.
CO2	Design Robots using kinematics theory.
CO3	Modelling and Optimising techniques of Robotics.
CO4	Understand the robot's eye vision and image processing.
CO5	Understand the programming used to control and intelligence algorithm for AI robots.

List of Experiments: MT605L

1.Robot Kinematics: Calculate the forward kinematics of a robotic manipulator given joint angles and geometric parameters.
2.Robot Control: Design and implement a controller to make a robot arm track a desired trajectory using inverse kinematics and feedback control.
3.Soft Robotic Actuation: Build and control a soft robotic gripper using electroactive polymer actuators or shape memory alloys.
4.Image Filtering: Apply linear filters such as Gaussian and Sobel filters to enhance images and extract edges.
5.Feature Extraction: Implement corner detection algorithms like Harris corner detector and extract descriptors using SIFT or SURF .
6.AI and ML based problem and design of ROBOTICS.

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