Madhav Institute of Technology & Science, Gwalior

List of Department Elective Courses offered under Flexible Curriculum Scheme (Session Jan-June 2020) offered from Online Moocs

Name of Department	Name of Courses	Syllabus of the Course (Available in SWAYAM Portal)	Duration of Course (In Weeks)	Course start date	Course End Date	Exam Date	Name of Mentor Faculty (One Regular & one NPIU)	URL link for Registration (From SWAYAM Portal)
Electrical Engineering	**Non conventional Energy Resources**	COURSE LAYOUT Week 1 : Scale of quantities, Impact of current energy usage, Conventional sources of energy Week 2 : Overview of non-conventional energy resources, Consumption by sector Week 3 : Solar energy incident on earth, solar spectrum Week 4 : Overview of solar energy technologies, Solar Thermal devices Week 5 : Solar Photovoltaic devices, Performance and durability of solar devices Week 6 : Wind energy, technology and geographical aspects Week 7 : Geothermal and Biomass Week 8 : Battery basics, types Week 9 : Testing, performance of batteries Week 10 : Fuel cell types, Fuel processing, concept to product. Week 11 : Characterization and durability of fuel cells Week 12 : Flywheels and super capacitors	**12 Weeks**	**January 27, 2020**	**April 17, 2020**	**April 26, 2020**	Prof.Vishal Chaudhary	https://swayam.gov.in/nd1_noc20_ge06/preview
	DC Power Transmission Systems (IIT-Madras)	COURSE LAYOUT Week :1 Choice of Converter Configuration for any Pulse Number Week :2 Analysis of 6 Pulse Line Commutated Converter Week :3 Capacitor Commutated Converter Week :4 12 Pulse Line Commutated Converter Week :5 Types of DC Link Week :6 DC Link Control Week :7 Multi-Terminal DC System – Applications, Types Week :8 Non-characteristic Harmonics Week :9 Filters – Design of Single Tuned Filter Week :10 Comparison of AC and DC Transmission – Economics and Technical Performance	**12 weeks**	**27-Jan-20**	**17-Apr-20**	**25-Apr-20**	Prof.Bhavana Rathore	https://swayam.gov.in/nd1_noc20_ee09/preview
	Fuzzy Logic and Neural Networks	COURSE LAYOUT Week 1 : Introduction to Fuzzy Sets Week 2 : Introduction to Fuzzy Sets (contd.); Fuzzy reasoning Week 3 : Fuzzy reasoning (contd.); Fuzzy clustering Week 4 : Fuzzy clustering (contd.); Fundamentals of Neural Networks Week 5 : Multi-layer Feed-Forward Neural Network; Radial Basis FunctionNetwork Week 6 : Self-Organizing Map; Counter-Propagation Neural Network;Recurrent Neural Networks; Deep Learning Neural Network Week 7 : Genetic-Fuzzy system; Genetic-Neural System Week 8 : Neuro-Fuzzy System; Concepts of Soft Computing andComputational Intelligence; Summary of the Course	**8 Weeks**	**February 24, 2020**	**April 17, 2020**	**April 26, 2020**	Dr.Sulochana Wadhwani	https://swayam.gov.in/nd1_noc20_ge09/preview

Electronics Engineering	**Spread Spectrum Communications and Jamming (IIT Kharagpur)**	COURSE LAYOUT Week 1: Types of Spread Spectrum Systems: Different Spreading Techniques will be addressed Week 2: Spreading Sequences: Generation Mechanism of sequences and Waveforms Week 3: Properties of Spreading Sequences: Code Properties and comparative studies Week 4: Systems under Jamming: Performance Analysis Week 5: Galois Field Mathematics: Concept of code generator polynomial and characteristic equation Week 6: Interference Rejection Techniques Week 7: Code Acquisition Mechanism Week 8: Code Tracking Mechanism Week 9: Concept of Fading Channels and Diversity Week 10: CDMA Technology and Interference Handling Mechanisms Week 11: MUD and Performance Analysis of CDMA Networks Week 12: WCDMA; Low Probability of Intercept Methods	**12 Weeks**	**January 27,2020**	**April 17,2020**	**26-Apr-20**	Dr. Karuna Markam	https://swayam.gov.in/nd1_noc20_ee34/preview
	Digital IC Design (IIT Madras)	COURSE LAYOUT Week 1: The CMOS Inverter construction and Voltage Transfer Characteristics Week 2: Resistance and Capacitance and transient response. Week 3: Dynamic, Short Circuit and Leakage power – Stacking Effect Week 4: Combinational Circuit Design and capacitance Week 5: Parasitic Delay, Logical Effort and Electrical Effort Week 6: Gate sizing and Buffering Week 7: Asymmetric gate, Skewed gates, Ratio'ed logic Week 8: Dynamic Gates and Domino logic and Static Timing Analysis Week 9: Sequential circuits and feedback. Various D flip flop circuits – Static and Dynamic Week 10:Setup and Hold Time measurement. Timing analysis of latch/ flop based systems Week 11:Adders – Mirror adder, Carry Skip adder, Carry Select adder, Square Root adder Week 12:Multipliers – Signed and	**12 Weeks**	**January 27,2020**	**April 17,2020**	**26-Apr-20**	Prof. Madhav Singh	https://swayam.gov.in/nd1_noc20_ee05/preview
	Antennas (IIT Bombay)	COURSE LAYOUT Week 1 : Lecture 1-5:Antenna Introduction-I-V Week 2 : Lecture 1,2:Antenna Radiation Hazards-I-II Lecture 3-5:Dipole Antennas-I-III Week 3 : Lecture 1,2:Monopole Antennas-I-II Lecture 3,4:Loop Antennas, Slot Antennas Week 4 : Lecture 1-4:Linear Arrays-I-III, Planar Arrays Week 5 : Lecture 1-5:Microstrip Antennas(MSA), Rectangular MSA, MSA Parametric Analysis-I-II, Circular MSA Week 6 : Lecture 1-5:Broadband MSA-I-V Week 7 : Lecture 1-5:Compact MSA-I-V Week 8 : Lecture 1,3:Circularly Polarized MSA-I-III Lecture 4-5:MSA Arrays-I-III Week 9 :	**12 Weeks**	**January 27,2020**	**April 17,2020**	**25-Apr-20**	Prof. Deep Kishore Parsediya	https://swayam.gov.in/nd1_noc20_ee20/preview

Civil Engineering	***Maintenance and Repair of Concrete Structures***	COURSE LAYOUT Week 1 : Module 1.1: Introduction, significance of corrosion, and corrosion mechanisms Week 2 : Module 1.2: Embedded metal corrosion Week 3 : Module 2.1: Deterioration of cementitious systems – Sulphate and Acid attack Week 4 : Module 2.2: Deterioration of cementitious systems – Alkali Silica Reaction (ASR), Shrinkage, and others Week 5 : Module 3.1: Concrete assessment using non-destructive tests (NDT) Week 6 : Module 3.1: Concrete assessment and load effects Week 7 : Module 4.1: Surface repair – Condition assessment Week 8 : Module 4.2: Surface repair – Analysis, strategy, and design Week 9 : Module 4.3: Surface repair – Material requirement, surface preparation, placement of repair material Week 10 : Module 5.1: Strengthening and stabilization – Introduction and beam shear capacity strengthening Week 11 : Module 5.2: Strengthening and stabilization – Column strengthening Week 12 : Module 5.3: Strengthening and stabilization – Flexural strengthening	**12 Weeks**	**January 27, 2020**	**April 17, 2020**	**April 25, 2019**	**Prof. Archana Tiwari and Dr. Pankaj Kumar**	https://swayam.gov.in/nd1_noc20_ce26/preview
	Geotechnical Engineering II (Foundation Engineering)	COURSE LAYOUT Week 1 : Introduction and quick review of Soil Mechanics Week 2 : Shallow Foundation and Bearing Capacity Week 3 : Bearing Capacity theories and its application Week 4 : Settlement of Footing Week 5 : Soil Exploration and Geotechnical Investigation Week 6 : Earth Pressure Theories Week 7 : Stability Analysis of Retaining wall Week 8 : Deep Foundations type, selection and load transfer mechanism Week 9 : Pile capacity, pile load test and settlement Week 10 : Sheet pile wall Week 11 : Deep Excavation Week 12 : Introduction to Machine foundation	**12 Weeks**	**January 27, 2020**	**17-Apr-20**	**April 26, 2020**	**Dr. Pratibha Singh and Prof. Shivendra S. Kushwah**	https://swayam.gov.in/nd1_noc20_ce10/preview
	Energy Efficiency, Acoustics and Daylighting in Building	COURSE LAYOUT Week 1 : Environmental Factors: Factors and their representation, tropical environments and site environments, etc. Week 2 : Human response to environment: Factors affecting human comfort, Human response to thermal environment, noise, visual environment etc.; Comfort indices Week 3 : Response of building to thermal environment: Processes of heat exchange of building with environment; Effect of solar radiation; Thermal properties of material and sections and their influence Week 4 : Steady and periodic heat transfer in buildings Week 5 : Heat flow computations: Transmission matrix, Admittance method, etc.-1 Week 6 : Heat flow computations: Transmission matrix, Admittance method, etc.-2 Week 7 : Structural control and design for energy efficiency: Selection of envelope elements, Orientations, shape, Glasses and shading devices Week 8 : Natural ventilation: Purpose of ventilation, Mechanisms, Fenestration Design for natural ventilation Week 9 : Noise and Building: Basic acoustics and noise, Planning, Sound in free field, protection against external noise Week 10 : Internal noise sources and protection	**12 Weeks**	**January 27, 2020**	**April 17, 2020**	**April 26, 2020**	**Prof. A.K. Saxena and Prof. Almas Siddiqui**	https://swayam.gov.in/nd1_noc20_ce08/preview
Mechanical Engineering	Power Plant Engineering	COURSE LAYOUT Week 1 : The energy scenario, steam power plants, fuel handling, ash handling, chimney draught Week 2 : Fossil fuel steam generators, high pressure boilers, performance of boilers, fuels and combustion, steam turbines Week 3 : Impulse turbines, reaction turbines, feed water treatment, steam condensers, problem solving Week 4 : Condensate feed water system, circulating water system,	**8 Weeks**	**January 27, 2020**	20-Mar-20	**March 29, 2020**	Updated Soon	https://swayam.gov.in/nd1_noc20_me10/preview

	Fundamental of welding science and Technology	COURSE LAYOUT Week 1 : Introduction and classification of welding Week 2 : Nomenclature and symbol of welding joints Week 3 : Power source of welding Week 4 : Physics and principle of arc welding Week 5 : Different type of welding methods and their details Week 6 : Different type of welding methods their details Week 7 : Different type of welding methods their details Week 8 : Welding defects and inspection	**8 Weeks**	**January 27, 2020**	20-Mar-20	**March 29, 2020**	Updated Soon	https://swayam.gov.in/nd1_noc20_me23/preview
	Gear And Gear Unit Design : Theory And Practice	COURSE LAYOUT Week 1: Introduction to Gear and Gear unit Design Week 2: Design of Spur (Straight and Helical), Bevel and Worm gears. Week 3: Design of a gear box- part-1 Week 4: Design of a gear box- part-2 Week 5: Design of a gear box- part-3 Week 6: Design of a gear box- part-4 Week 7: Introduction to Involute Gear Tooth Correction Week 8: Internal Gearing, Epicyclic and other special Gearing	8 Weeks	24/Feb/20	17/Apr/20	25-Apr-20	Updated Soon	https://swayam.gov.in/nd1_noc20_me18/preview
Automobile Engineering	**Fundamentals of combustion for propulsion**	COURSE LAYOUT Week 1 : Lecture 1 – Equilibrium: physical, thermodynamic and chemical Lecture 2 – Equilibrium controlled and rate controlled processes in gaseous, liquid and solid fuels Lecture 3 – Calculation of equilibrium states Week 2 : Lecture 4 – Laminar premixed and diffusion flames: principal features and differences Lecture 5 – Quenching, flammability and other limit phenomena Lecture 6 – Discussion of burning behavior of gaseous, liquid and solid fuels Week 3 : Lecture 7 – Basics of composite solid propellant deflagration Lecture 8 – Why model deflagration of composite propellants? Lecture 9 – Statistical representation of composite propellants in HeQu1D – geometry and thermochemistry Week 4 : Lecture 10 – Idea of lateral diffusion Lecture 11 – Overview of the HeQu1D software and demonstration Lecture 12 – Effect of aluminum Week 5 : Lecture 13 – Erosive burning Lecture 14 – Instability in solid rockets – 1	**8 Weeks**	**January 27, 2020**	20-Mar-20	**March 29, 2020**		https://swayam.gov.in/nd1_noc20_me38/preview
	Robotics and Control : Theory and Practice	COURSE LAYOUT Week 1 : Simple manipulators: Two /three arm manipulators and their kinematics equations, Work space Homogeneous Transformation: Rotation, Translation, Composition of homogeneous transformations Week 2 : Danavit-Hartimber Algorithm: D-H procedure for fixing joint coordinate frames, Robot parameters, Arm matrix, Inverse Kinematics for PUMA, SCARA manipulators. Week 3 : Introduction to Robotic Exoskeletons,Optimal Design of a Three Finger Exoskeleton for Rehabilitation Purpose Week 4 : Differential transformation and velocity of a frame: Derivative of a frame, Velocity, Jacobian, Inverse Jacobian, Trajectory Planning: Polynomial trajectory, Biped trajectory Week 5 : Dynamics: Lagrangian method, Robot dynamics equation,Control: Robot dynamics equation as a control system, Trajectory tracking control, PD controller, Neural network control design Week 6 : Redundancy Resolution of Human Fingers using Robotic Principles,Manipulability Analysis of Human	**8Weeks**	**January 27, 2020**	20-Mar-20	**March 29, 2020**		https://swayam.gov.in/nd1_noc20_me03/preview

	Fundamentals of Automotive system	COURSE LAYOUT Week 1 : Course Overview, Classification of Internal Combustion Engines, Engine Components, Operation of Four Stroke Engines Week 2 : Two Stroke Engines, Engine Cycles Week 3 : Engine Performance, Supercharging, Combustion in Spark Ignition Engines Week 4 : Combustion in Compression Ignition Engines, Carburetion, Fuel Introduction Systems Week 5 : Engine Emissions, Emission Control Systems, Automotive Powertrain Week 6 : Automotive Clutch, Transmission, Powertrain Analysis Week 7 : Transmission Matching and Introduction to Brake System Week 8 : Components of Brake System, Hydraulic Brake Week 9 : Air Brake, Antilock Brake System Week 10 : Braking Analysis, Introduction to Steering System, Manual Steering System Week 11 : Power Steering System, Wheel Alignment, Introduction to Suspension System Week 12 : Components of Suspension System, Dependent and Independent	**12weeks**	**January 27, 2020**	**April 17, 2020**	**April 25, 2020**		https://swayam.gov.in/nd1_noc20_de06/preview
Chemical Engineering	Chemical Reaction Engineering II	Week 1 : Introduction, Introduction to catalysis and catalytic processes, Catalyst properties and classification, Steps in catalysis, Adsorption isotherm Week 2 : Surface reaction, Rate controlling steps and Rate law, Rate law: Pseudo-steady state hypothesis, Heterogeneous data analysis for reactor design Week 3 : Design of reactors: PBR and CSTR, Case study: Chemical Vapor Deposition, Catalyst deactivation Week 4 : Catalyst deactivation: Reactor design, Diffusional effects: Introduction, Internal diffusion effects: Model development, Thiele modulus, Concentration profile Week 5 : Internal effectiveness factor, Falsification of kinetics, External mass transport limitations Week 6 : Mass transfer coefficient, Mass transfer to a single particle with reaction, Packed-bed reactor design, Mass transfer coefficient in Packed-beds, Example problems Week 7 : Overall effectiveness factor, Identification of internal diffusion- and reaction-limited regimes, Packed-bed reactor design, Generalized criterion Week 8 : Network of first order reactions, Use of experimental data, Packed-bed reactor design with external and internal mass transfer limitations, Fluidized bed reactor design Week 9 : Fluidized bed reactor design, Fluid-solid non-catalytic reactions Week 10 : Fluid-solid non-catalytic reactions, Residence time distribution (RTD): Introduction, Non-ideal reactors Week 11 : Measurement of RTD, RTD function, Properties of RTD function, Reactor diagnostics and troubleshooting	12 Weeks	27-Jan-20	17-Apr-20	25-Apr-20	Prof. Swati Gupta & Prof. Anish P. Jacob	https://swayam.gov.in/nd1_noc20_ch13/preview
	Multiphase Flows	Week - 1 Multiphase flow introduction, Fundamental definitions and terminology used Week - 2 Flow-pattern map for fluid-fluid (gas-liquid and liquid-liquid) and flow regime map for fluid-solids flows Week - 3 Pressure drop and Volume fraction calculation for Homogeneous regimes: Using momentum balance equation from equation of motion and empirical correlations Week - 4 Pressure drop and Volume fraction calculation for Segregated/Separated regimes: Using equation of motion and empirical correlations. Week - 5 Multiphase Interactions: Drag, lift, virtual mass force, Basset force, one way, two way, three-way and four-way coupling and mathematical formulation of the same. Week - 6 Modelling Methods for Multiphase Flows: Mixture Model, Euler-Euler Model and Euler-Lagrangian Model	8 Weeks	27-Jan-20	20-Mar-20	29-Mar-20	Prof. Swati Gupta	https://swayam.gov.in/nd1_noc20_ch14/preview
	Membrane Technology	Week 1: Overview and membrane materials Week 2: Material properties and preparation of phase-inversion membranes Week 3: Preparation of composite, inorganic membranes and MF characterization Week 4: MF and UF characterization and membrane transport Week 5: Porous and non-porous membrane transport and Osmosis concepts Week 6: Reverse Osmosis and Nanofiltration Week 7: Ultrafiltration basics, transport models, applications Week 8: Micellar-enhanced and affinity UF, bioseparation, Microfiltration basics, transport, fouling and applications Week 9: Problems and solutions based on RO, UF & MF, Dialysis Week 10: Electrodialysis, Pervaporation, Problems and solutions based on ED, PV Week 11: Liquid Membranes, Gas separation, Membrane Distillation Week 12: Facilitated Transport, Membrane contactors and other membrane processes	12 Weeks	27-Jan-20	17-Apr-20	25-Apr-20	Prof. Anish P.Jacob & Dr. K. Samal	https://swayam.gov.in/nd1_noc20_ch04/preview

CSE & IT Engineering	Data Analytics with Python	COURSE LAYOUT Week 1 : Introduction to data analytics and Python fundamentals Week 2 : Introduction to probability Week 3 : Sampling and sampling distributions Week 4 : Hypothesis testing Week 5 : Two sample testing and introduction to ANOVA Week 6 : Two way ANOVA and linear regression Week 7 : Linear regression and multiple regression Week 8 : Concepts of MLE and Logistic regression Week 9 : ROC and Regression Analysis Model Building Week 10 : c2 Test and introduction to cluster analysis Week 11 : Clustering analysis Week 12 : Classification and Regression Trees (CART)	**12 weeks**	**January 27, 2020**	**April 17, 2020**	**April 25, 2020**	Dr. Saniv Sharma, Prof. Namrata Agrawal	https://swayam.gov.in/nd1_noc20_cs46/preview
	Introduction to Machine Learning	COURSE LAYOUT Week 0: Probability Theory, Linear Algebra, Convex Optimization - (Recap) Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance Week 2: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares Week 3: Linear Classification, Logistic Regression, Linear Discriminant Analysis Week 4: Perceptron, Support Vector Machines Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation Week 6: Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes,	**12 weeks**	**January 27, 2020**	**April 17, 2020**	**April 25, 2020**	Prof. Mahesh Parmar, Prof. Arun Kumar	https://swayam.gov.in/nd1_noc20_cs29/preview
	Cloud computing	COURSE LAYOUT Week 1: Introduction to Cloud Computing Week 2: Cloud Computing Architecture Week 3: Service Management in Cloud Computing Week 4: Data Management in Cloud Computing Week 5: Resource Management in Cloud Week 6: Cloud Security Week 7: Open Source and Commercial Clouds, Cloud Simulator Week 8: Research trend in Cloud Computing, Fog Computing	**8 weeks**	**January 24, 2020**	**April 17, 2020**	**April 26, 2020**	Porf. Khushboo Agarwal, Porf. Pooja Agrawal	https://swayam.gov.in/nd1_noc20_cs20/preview
Architecture	Sustainable Architecture	COURSE LAYOUT Week 1 : Fundamentals of sustainability, definitions, historical development of the concept of sustainability and sustainable development, Sustainable architecture as a subset of sustainable development. Week 2 : Impacts of built environment on natural environment, Sustainable Development, Agenda 21, UN Goals Week 3 : Characteristics of sustainable architecture, fundamentals of passive designing and climatology, thermal comfort, visual comfort, acoustic comfort Week 4 : Sustainable buildings, parameters of sustainable buildings, Green buildings, indicators of green buildings, Terminologies related to sustainable buildings- carbon	12 weeks	27 Jan 2020	17-Apr-20	25-Apr-20		https://swayam.gov.in/nd1_noc20_ar01/preview

Biotechnology	Interactomics : Basics & Applications	Updated Soon	12 weeks	January 27, 2020	April 17, 2020	April 25, 2020	Dr. Sunita Sharma	https://swayam.gov.in/nd1_noc20_bt02/preview
	Principles and Applications of NMR Spectroscopy	Updated Soon	08 weeks	January 27, 2020	March 20, 2020	March 29, 2020		https://swayam.gov.in/nd1_noc20_bt18/preview