# 5th SEM

# Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

**Plastic and Polymer Engineering, V-Semester**

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| **BPPT-501** | **Analysis and Characterization of Polymers** | **L** | **T** | **P** |
| **BPPP-501** | | **3** | **1** | **2** |

**Objectives:**

1. To introduce basic introduction, techniques for materials characterization and its importance
2. To provide basic descriptions of a characterization methods for the determination of the structure and composition of solids by spectroscopy techniques
3. To introduce the interpretation of the characterization technique of molecular weight and thermal properties of polymers.

**Course Outcome:**

1. Understanding of the fundamental testing of materials and able to identify basic techniques for specific materials Characterization.
2. Students will understand basic elements, operation and applications of Thermal analysis optical and electron microscopy techniques
3. Students will acquire the ability to analyze the data obtained from the techniques
4. Develop an ability to identify the ideal method of analysis to draw the required information.

**Detailed Content:**

**Unit I**

**Introduction to Characterization of Polymers**

Basic principles of spectroscopy, molecular and atomic spectra, Lambert-Bear law,
Frank-Condon principal, electromagnetic radiation, properties of electromagnetic radiation, interaction of radiation with matter: A classical picture, uncertainty and the question of time scale.

**Unit-II**

**Spectral Analysis of Polymers**

Principle, experimental technique and applications of IR , Ultraviolet–visible, Fourier transform infrared spectroscopy, , Nuclear magnetic resonance and mass spectroscopy of polymers.X-ray diffraction analysis -wide and small angle X-ray diffraction techniques.

**Unit-III**

**Molecular Characterization of Polymers**

Determination of molecular weight by molecular weight distribution, viscometry, end group analysis, colligative property, osmometry, light scattering technique, gel permeation chromatography (GPC) high-performance liquid chromatography (HPLC).

**Unit-IV**

**Thermal analysis**

Thermo gravimetric analysis (TGA), Differential thermal analysis (DTA), Differential scanning calorimetry (DSC), Dynamic mechanical analysis (DMA), Thermomechanical analysis (TMA) and Dynamic mechanical thermal analysis (DMTA), Basic theory, Instrumentation and applications

**Non-destructive testing:**
Basic principles:- Radiography, Ultrasonic, Thermography, Holography, Applications in airframe and rocketry.

**Unit – V**
**Microscopy and Surface Properties**
Microscopy: Basic principle of electron microscopy; specimen preparation, instruments, working and applications of scanning electron microscope (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM), contact angle measurements.

**Reference Books**
1. Instrumental method of analysis, by H. H. Willard, Wadsworth Publishing Co. Inc. (1988).
2. Principle of Instrumental Analysis, by D. A. Skoog, F. J. Holler, S. R. Crouch, Harcourt College (1997).
3. Handbook of Plastic Testing & Technology by V. Shah, Wiley-Interscience (2007).
4. Experimental Methods in Polymer Sciences by T. Tanaka, Academic Press (1999).
5. Spectrometric identification of organic compounds. Silverstein, Robert M John Wiley (2005).
6. A complete introduction to NMR spectroscopy by R. S. Macomber, Wiley-Interscience(2008).

**Suggested Experiments:**
1. Determination of molecular weight by viscometry.
2. Determination of K-value of PVC.
3. Characterization by Weight loss of common polymers by Thermo gravimetric Analysis
4. Characterization of Filler Content /Ash Content of common polymers by TGA
5. Characterization of Thermal stability of common polymers by Thermogravimetric Analysis.
6. Characterization by Melting Range of common polymers by Differential Scanning Calorimetry
7. Characterization by Tg of common polymers by Differential Scanning Calorimetry
8. Study of the curing behavior of epoxy resin system by Differential Scanning Calorimetry
9. Determination of Gel time of a thermoset resin at a given temperature.
10. Identification of a polymer by Infrared Spectroscopy.

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**Plastic and Polymer Engineering, V-Semester**

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| **BPPT-502** | **PLASTICS TESTING TECHNIQUES** | **L** | **T** | **P** |
| **BPPP-502** | | **3** | **1** | **2** |

**Objectives:**

1. To understand the principles of the fundamental concepts of Plastics testing techniques.
2. Develop an ability to perform the required test for plastic materials to certify the quality of the plastic product/ materials
3. To enable the students to interpret and evaluate the data of test results.

**Course Outcome:**

1. Demonstrate the knowledge of various National & International standards used for testing of various properties viz short term and mechanical, thermal, optical, inflammability, permeability.
2. Understand the various formula, test specimen requirements, and basic concepts involved during testing of different properties of plastics materials.
3. Select the appropriate National/ International standard for testing the required properties of plastic materials/products
4. Perform the required test for the physical, chemical, thermal, and electrical properties of plastic materials to certify the quality of the plastic product/ materials.
5. Evaluate the data of test results and Analyze the factors affecting the results of testing.

**Detailed Content:**

**UNIT-I:**

**Concepts of Testing & Identification Of Plastics Basic concepts of testing**

Specification and Standards – National and International Standards – Test specimen preparation – Pre-conditioning and test atmosphere. Identification of plastics by a simple test: Visual examination – Density – Melting point – Solubility test – Flame test – Chemical tests.

**UNIT-II**

**Mechanical Properties:** Stress-Strain curve, the stress-strain curve for the different polymer.
**Short Term:** Tensile, Compressive, Flexural,Shear, Impact & Tear strength.
**Long Term**: Creep Properties, Fatigue Resistance & Stress Relaxation properties.
**Surface Properties:** Abrasion Resistance, Hardness & Co-efficient of Friction

**UNIT-III**

**Thermal Properties:** Specific heat & Thermal conductivity, Thermal diffusivity, Linear thermalexpansion, Heat distortion temperature (HDT), &Vicat softening point (VSP)
**Flammability Properties:** UL94, Limiting Oxygen Index, Rate of burning & Smoke density.

**UNIT-IV**

**Electrical Properties:** Dielectric strength, Volume and surface resistivity, Arc resistance & Comparative tracking index (CTI)
**Optical properties:** Refractive index, Light transmission-Gloss-Clarity-Haze-Colour guard.

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**UNIT-V**

**Permanence Properties:** Water absorption, Chemical resistance, Environment stress cracking resistance, Gas permeability, Water vapor transmission/ permeability, Natural and Accelerated weathering - cause of deterioration of polymer by weathering.

**Reference Books:**


1. Handbook of Plastic Testing & Technology by Vishu Shah, Wiley- Interscience (2007).
2. Rubber Technology Handbook by Martin and Smith, Smithers Rapra Technology (2009).
3. SPI Plastic Engineering Handbook by M.L. Berins. Springer-Verlag (1991).
4. Blythe A R, Electrical Properties of Polymers, Cambridge University Press, Cambridge, (1979)


**Suggested Experiments:**

1. Determination of Ash Content in plastics materials.
2. Determination of Moisture Content in plastics materials.
3. Determination of Filler content in plastics materials.
4. Determination of Melt flow index of plastics materials.
5. Determination of Tensile strength, cross breaking strength, and shearing strength of plastics materials.
6. Determination of Impact strength (Charpy and Izod type) and compressive strength of plastics materials.
7. Determination of Electrical Properties of plastics materials such as break down voltage, insulation resistance, and arc resistance.
8. Determination of Density of plastic materials.
9. Determination of Bulk density for powder materials.
10. Determination of heat distortion temperature of plastic materials.
11. Determination of abrasion resistance of a polymer film.

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**Plastic and Polymer Engineering, V-Semester**

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| **BPPT-503** | **Plastic Processing-I** | **L** | **T** | **P** |
| **BPPP-503** | | **3** | **1** | **2** |

**Objectives:**

**1.** Understand the fundamentals of polymer processing techniques - extrusion, injection molding, compression and transfer molding

**2.** Understand construction and working of the processing equipment.

**3.** Understand effect of processing parameters on product properties.

**4.** Understand specialized processing techniques.

**Course Outcome:**

**1.** Understand the role of rheology in plastic processing, construction features of extruder, effect of process parameters, type & design of screw, barrel, dies on the output of extruder. Also. Application of transfer and compression moulding for processing of thermoset plastics

**2.** Select the design of the screw of extruder to suit the polymer to be extruded select the die of extruder as per profile of product to extruded.

**3**. Optimize the input processing parameters to obtain good quality and maximum output of the extruded products.

**4.** Identify the defects in the extruded products and suggesting suitable remedial action.

**5.** Analyze the importance and effect of various process variables affecting the extruded product quality.

**6.** Explain the transfer and compression molding for processing of thermoset materials.

**Detailed Content:**

**Unit – I**

Basic Principles of Melt Processing of Thermoplastics – Effect of Polymer Properties onProcessing Thermal behavior of Polymer Melt, flow behavior of polymer melts – Rheologyof Ideal Fluids and Polymers – Newtonian & Non-Newtonian fluids, Different Types ofProcesses and Limitations - Process Flow Charts – Selection of Process – Degradation –molecular orientation.

**Unit – II**

General description of extrusion processes, type of extruders, screw and their output in terms of drag, leakage and pressure flow, influence of screw dimensions and output, die and screw characteristics. Design of barrel and screw for commodity, heat sensitive and engineering polymers. BarrierScrews.

**Unit – III**

Individual extrusion systems, Dies, Sizing and Downstream equipment's, Faults, Causes and Remedies for film, pipe, lamination, profiles, cables, sheet, Box Strapping.

**Unit – IV**

Twin-screw extrusion and Co Extrusion systems. Casting of films. Multi-layer systems for Films and Pipe . Faults , Causes & Remedies.

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**Plastic and Polymer Engineering, V-Semester**

**Unit – V**

General description of Compression and Transfer moulding and its application in processing of thermosetting materials. Faults , Causes & Remedies

**Recommended Books :**


1. Berins , "Plastics Engineering Hand book" - Society of the Plastics Industry,(1991)
2. Allen , W.S & Baker , P.N. "Hand book of Plastics Technology, Hanser Publication, (2006)
3. Chris Rauwendaal, "Polymer Extrusion" Hanser Publication,(2001)
4. lsayev, A.I "Compression molding" Marcel Dekker Inc,(1989)


**Suggested Experiments:**

**1. Introduction**

Introduction to Plastics Processing Machineries

**2.Shop-floor and Machine safety**

Machine, mold, tools handling and safety measures on the shop-floor.

**3.Hand operated Injection Molding Machine**

**(i)** Study of Machine in **Idle-Run Observation (IRO)**, Parts &functions, operating principle, Freesketch of Machine-parts e.g.Nozzle, Torpedo, Hopper, Rack &Pinion Barrel etc., shot capacitydefinition

**(ii)** Operation practice to produce molding on different hand injection moulds. Recording the observation and results in practical record books.

4. **Injection Molding Semi-Automatic**

**(i)** Study of Semi-Automatic Injection Molding M/cs of all types in IRO. Comparative study of Pneumatic type & Hydraulic type of M/cs, Operating Principle of M/cs. Linediagrams of M/cs with nomenclature of parts, M/cs specifications.

**(ii)** Operation of Pneumatic & Hydraulic type of Semi-automatic Injection molding M/cs, to produce components in different moulds. Cycle-time analysis, observations of Process- Parameters & Procedure to be recorded.

**5. Injection Molding M/c. - Automatic**

**(i)** Study of M/c Parts & function, Study of clamping systems on M/cs, Technical specification of Machine,study of process sequence in Machine, Study & definitions of terms related to M/c operation e.g. M/c Day light, Locating-Ring Dimensions, ejector-stroke, Tie-Bar distance, M/c Platen sizes &mould clamping arrangements. Definitionsof all processing parameters & study of controls in M/cs.

**(ii)** Idle-run observation (IRO) & study of Injection Unit, Clamping Unit, Process- Control knobs, safetyprecautions, start-up Procedure, Shutdown Procedure, Sketch of Machine

Platens, Clamping system, type of nozzle used in M/c etc., study of Hydraulic System used in the M/c. M/c Operation-Practice, Process parameter setting for a particular mould on the Machine, Operation of Machine in Hand, Semi-Automatic& Automatic-mode to produce components, observations of all parameters, cycle-time analysis, use of different plastics material for molding & comparison, Molding faults analysis for causes and remedies.

**6. Extrusion Processes on Extruders**

**(i)** Study of Extruders in IRO, Free sketch of machines, their parts and parts-function, List of products manufactured by Extrusion- Process. Study of different types of extrusion process.

**(ii)** Operation-Practice by Trainee on setting up of Process-parameter to produce Blown-Film on Film plant, observations on extruder output, size of film produced and technical specifications of machines to be recorded.

**7. Blow Molding Hand Operated**

**(i)** Study of Hand Blow Molding M/cs, Free-sketch of M/c with parts & study of part-function, Specification of M/c, Study of Parison-die with sketch.

**(ii)** Die-centering practice by Trainees, operation of Hand Blow Machines, to produce components observations, cycle-time analysis Procedure of operation and observations.

**8.** Blow-Molding Semi-Automatic Technical specification of M/c, Mould clamping on M/c, operation Practice with different moulds, Familiarization with control-switches/ valves on the M/c, cycle-time analysis & procedure of operation of M/c.

**9. Scrap Grinding Hopper Drier, MTC, Chiller, other auxiliary equipment.**

**(i)** M/c Study in IRO, specification of M/c, study of parts & function, Line Diagram of M/c operation practice with different materials and output study in Kg/hour for different materials.

**(ii)** Study of Hopper drier, Mold Temperature controller, Chillers & other ancillary equipment's and water quality

**10.** Introduction to Maintenance Basic knowledge of Hydraulic & Pneumatic systems, Electrical system, Definition of terms- Hydraulic fluid, viscosity Directional Valves, Resistance, Current, Voltage, Power, Hydraulic Pumps - Types & function, electrical heaters, thermocouples and temperature control parameters and timers, electrical Motors - Types & function.

**11.** Introduction to Moulds, Tool Room Machines & Drawing Practice Study of Different Types of Moulds& its Parts and function, free hand drawing practice, exposure to tool room machines.

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**Plastic and Polymer Engineering, V-Semester**

| BPPT-504(A)Polymer Structure and Properties Relationship | L | T | P |
|---|---|---|---|
| | 3 | 1 | 0 |

**Objectives:**

1. Understand the effect of submolecular level chemical structure (types of elements and bonds present in polymer chain) on polymer properties

2. Understand the effect of molecular level chemical (intermolecular bonds) and physical structure (size, shape, chain flexibility, morphology) on polymer properties.

3. Understand correlation between structure and properties, thereby, requirements for processing techniques as well as applications

**Course Outcome:**

1. Understand different types of polymer structures, their co-relation with physical, chemical, thermal, optical and electrical properties of polymers
2. Understand the significance and concepts of testing procedures used for all mechanical properties of polymers/plastic materials.
3. Remember the various formulas relating properties with structural parameters of the polymers
4. Predict the desired properties from the structure of a given polymer
5. Analyze structure and properties of various polymers to suggest a specific polymer for a desired application.

**Detailed Content:**

**UNIT-I**

Structure of polymers. Linear, branched, cross linked, and network polymers. Homochain and hetero atomic chain polymers. Copolymers, Linear and cyclic arrangement. Prediction of polymer properties, group contribution techniques, topological techniques. Volumetric properties - molar volume, density, Van der Waals volume. Coefficient of linear thermal expansion and volumetric thermal expansion. Pressure volume temperature (PVT) relationship.

**Unit-II**

Mechanical properties . Stress-strain properties of polymers. Effect of polymer structure on modulus of elasticity, tensile strength, flexural strength, impact strength, yield strength, fracture toughness . Crazing in glassy polymers. Ductile brittle transition. Effect of additives on mechanical properties of polymers. Creep, stress relaxation, and fatigue.

**Unit-III**

**Thermodynamic and transition properties:** Transition temperature in polymers, glass transition (Tg), melt transition (Tm), relationship between Tg and Tm. Other transitions like ß-transitions, upper and lower glass transition temperatures. Prediction of Tg and Tm of polymers by group contributions. Calorimetric properties - Heat capacity, specific heat, latent heat of crystallization and fusion, enthalpy and entropy. Calculation of heat capacities of polymers.

**Unit -IV**

**Electrical properties** : Effect of polymer structure on dielectric constant, power factor, dissipation factor, and loss factor. Effect of frequency of voltage and temperature on dielectric properties. Prediction of molar polarization and effective dipole moment. Effect of additives on electrical properties ofpolymers.

**Optical properties:** Effect of polymer structure on optical properties - clarity, transparency, haze, transmittance, reflectance, and gloss. Prediction of refractive indices of polymers by group contributions

**Unit -V**

**Chemical Properties** : Cohesive energy, cohesive energy density, solubility parameter, determination of solubility parameter of polymers , Prediction of solubility parameter, Effect of polymer structure on solubility in solvents and oils, Influence of structure in prediction of flame retardancy, water repellency, Chemical resistance ofpolymers.

**References Books:**

1. D.W. Van Krevelen And P.J. Hoftyzen, "Properties Of Polymer , 3rd Edition Elsevier Scientific, Publishing Company Amsterdam - Oxford - Newyork.(1990).
2. J.E. Mark Ed.AIP, Physical Properties Of Polymers Hand Book, Williston, Vt,(1996).
3. A Text book of Polymer Science by F.W. Billmeyer, John-Wiley and Sons(2011).
4. Polymer Chemistry by R. B. Seymour and C.E. Carraher, Marcel Dekker(2003).

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**Plastic and Polymer Engineering, V-Semester**

| BPPT-504(B) | Conducting Polymers | L | T | P |
|---|---|---|---|---|
| | | 3 | 1 | 0 |

**Objectives:**

1. To develop knowledge of conducting polymers and its properties.
2. To provide basic descriptions of a characterization techniques of conducting polymers.
3. To introduce the mechanisms and synthesis involved in conducting polymers

**Course Outcome:**

1. Understanding of the basics of conducting polymers and their conduction mechanism
2. Understand various types of conducting polymers and their properties
3. Acquire knowledge about various mechanisms and techniques used in synthesis of conducting polymers
4. Understand various characterization techniques for conducting polymers
5. Acquire knowledge of various applications of conducting polymers.

**Detailed Content:**

**UNIT I**

**Introduction**

Needof conducting polymers, Classification of conducting polymer, Concept of doping,n-Type, p- Type, Electrochemistry of electronically conducting polymers-source of electronic conduction in polymers, polaron, bipolar on, conduction mechanism.

**UNIT II**

**Properties of conductingpolymers**

Structure-property relationship, Types of conducting polymers, e.g. Polyaniline (PANI), Polypyrrole, (Polythiophene (PTh), Discovery of polyacetylene

**UNIT III**

**Synthesis of conducting polymer**

Chemical synthesis, electrochemical synthesis, template synthesis, precursor synthesis, soluble polymers (Colloid and dispersion), advantage and disadvantage of various synthesis methods. General Methodology; Synthesis and processability of selected conducting polymers like – Polyacetylene, Polyaniline, Polypyrrole, Polythiophene and Poly-para – phenylene

**UNIT IV**

**Analytical Techniques for Characterization of Conducting polymers**

IR ,UV, Impedance spectroscopy, Fourier Transform Infra-red spectroscopy, X-ray photoelectron spectroscopy, Scanning Electron microscopy (SEM), Transmission electron microscopy(TEM), Electrochemical quartz crystal micro balance(EQCM), Four Probe conductivity measurement, Galvanostat/Potentiostat

**UNIT V**

**Applications**

Rechargeable batteries, o-LED, Gas sensors, Bio sensors, Photovoltaic energy device, Microelectronics, PCB fabrication, Electro catalyst. Application proposed antistatic coating, electrochemical mechanical device, super capacitor, Telecommunication system, Electromagnetic screening material, Analytical sensor.

Recent trend in conducting polymer, functionalized conducting polymer (Second generation polymer), Super conductor (Inorganic, organic hybrid structure), Conducting polymer based on nano composite.

**Reference Books:**

1. HandbookofConductingPolymers:TerjeA.Skotheim(Vol.l),Dekker(668.42)
2. HandbookofPolymerSynthesis(PartB):HansKricheldorf,Dekker(668.9).
3. Sensors:PrinciplesandApplications:PeterHauptmann,PrenticeHall
4. PolymerScienceandTechnology:PremamoyGhosh,TataMcGrawHill(668.42).
5. Handbookoforganicconductivemoleculesandpolymers,HarisinghNalwa(ed.),4-Volumeset,Johnwileyandsons,England1997.
6. Electrochemicalscienceandtechnologyofpolymers-1&2ed.,R.GLinford,Elsevierapplied sciences,London1987and1989.

# Uttarakhand Technical University, Dehradun

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**Plastic and Polymer Engineering, V-Semester**

| BPPT-504(C) | Speciality Polymers | L | T | P |
|---|---|---|---|---|
| | | 3 | 1 | 0 |

**Objectives:**

1. To enable the students to understand the various properties and application involved in Speciality polymers.
2. To understand the concept of polymer concrete and polymer in telecommunication and transmission

**Course Outcome:**

1. Understand about the properties of fire resistant and high temperature polymers
2. Acquire knowledge about polymers with electrical properties
3. Acquire knowledge of ionic polymers and their applications
4. Understand various application of speciality polymers in telecommunication and transmission
5. Understanding of polymer concrete and its applications.

**Detailed Content:**

**UNIT I**

High temperature and fire resistant polymers improving low performance polymers forhigh temperatureuse–polymersforlowfirehazards–polymersforhightemperatureresistance– Fluoropolymers. Aromatic polymers, polyphenylene sulphide,polysulphones, polyesters, polyamides,poly ketones,Heterocyclicpolymers.

**UNIT II**

Polymers with electrical and electronic properties - Conducting polymers, conducting mechanisms, polyacetylene, polyparaphenylene, polypyrrole, organometallic polymers, photo conducting polymers, polymers in non-linear optics, polymers with piezoelectric and pyroelectric properties,photoresistsforsemi-conductorfabrication – liquidcrystallinepolymers. Types of electroactive polymers; Dielectric, Ferroelectric (Electro strictive and liquid crystalline) and ionic (electrorheological fluid and ion-metal composite) EAP‘s; Comparison of electronic and ionicbehaviors

**UNIT III**

IonicPolymers,synthesis,physicalpropertiesandapplications,Ion-exchange,Hydrophilicity, ionomers based on polyethylene, elastomeric ionomers. Ionomers based on polystyrene, ionomers based on PTFE, ionomers with polyaromatic backbones, polyelectrolytes for ion exchange, polyelectrolytes based on carboxylates, polymers with integral ions, polyelectrolyte complexes.Biologicalandinorganicionicpolymers.

**UNIT IV**

Polymer concrete, polymer impregnated concrete ultra-high modulus fibres, polymers for biomedical applications, polymeric binders for rocket propellants, polymer supported reagents.Definition, classification, synthesis, characterization and application of polymer gels.

**UNIT V**

Polymersintelecommunicationsandpowertransmission,polymersasinsulators–electrical breakdown strength – capacitance, dielectric loss and cable alteration, polymers in telecommunicationssubmarine, cable insulation, low firerisk materials, polymers inpower transmission – Optical fibretelecommunication cables. Photoactive polymers their design, synthesis, characteristic propertiesanditsapplication.

**References Books :-**

1. H.F.Mark,(Ed),EncyclopediaofpolymerScience&Engineering,JohnWiley&Sons,New York,1989.
2. Matrin.T.Goosey,PlasticsforElectronics,Elsevier,AppliedScience,1985.
3. ManasChanda,Salil.K.Roy,PlasticsTechnologyHandbook,2ndedition,MarcelDekker, New York,1993.
4. R.W.Dyson,SpecialtyPolymers,Chapman&Hall,2ndedition,1998.

# Uttarakhand Technical University, Dehradun

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**Plastic and Polymer Engineering, V-Semester**

| BMET- 505 (A) Principle of Management | L | T | P |
|---|---|---|---|
| | 3 | 0 | 0 |

**Objectives:**

1. Toenablethestudentstostudythe evolution ofManagement.
2. Tostudythefunctionsandprinciplesofmanagement.
3. Tolearntheapplicationoftheprinciplesinanorganization.
4. Toenabletheeffectiveandbarrierscommunicationintheorganization
5. Tostudythesystemandprocessofeffectivecontrollingintheorganization

**Course Outcome:**

1. Studentswillbeabletohaveclearunderstandingofmanagerialfunctionslikeplanning,andhave samebasicknowledgeoninternationalaspectofmanagement.
2. Tounderstandtheplanningprocessintheorganization
3. Tounderstandtheconceptoforganization
4. Demonstratetheabilitytodirecting,leadershipandcommunicateeffectively
5. Toanalysisisolateissuesandformulatebestcontrolmethods

**Detailed Content:**

**UNIT 1**

**INTRODUCTION TO MANAGEMENT:** Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system.

**UNIT 2**

**MANAGEMENT INFORMATION:** Interaction with external environment. Managerial decision making and MIS.

**UNIT 3**

**PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS:** design of organization structure; job design and enrichment; job evaluation and merit rating. 3

**UNIT 4**

**MOTIVATION AND PRODUCTIVITY**: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies.

**Suggested Books:**


1. Schermerhorn,; Management and Organizational Behaviour essentials, WileyIndia
2. Koontz: Essentials of Management, PHILearning.
3. Hirschey: Managerial Economics, CengageLearning.
4. A V Rau: Management Science, BSP, Hyderabad
5. Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, NewDelhi.
6. Stephan R Robbins Fundamental of Management,Pearson

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**Plastic and Polymer Engineering, V-Semester**

| BMET- 505 (B) TQM and SQC | L | T | P |
|---|---|---|---|
| | 3 | 0 | 0 |

**Objectives:**

1. To facilitate the understanding of total quality management principles and processes
2. Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
3. Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality.
4. Critically appraise the organizational, communication and teamwork requirements for effective quality management.
5. Critically analyses the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans.

**Course Outcome:**

1. Analyze& Correlate the importance of qualitycontrol
2. Compare and analyze the concept of QualityManagement
3. To analyze the concept of qualitycircle.
4. Categorize and apply Quality function, decentralization and Theory of controlcharts
5. Distinguish different types IS0-9000 series and its concept ofQuality.

**Detailed Content:**

**Unit 1**

**Evolution** of total quality management, historical perspective, teamwork, TQM and ISO 9000; information technology and Business Process Re-engineering (BPR); TPM and quality awards; aids and barriers to quality mgt, creating vision and initiating transformation, establishing programs for education and self-coordination, policy setting and review, flowchart of policy mgt and relation with daily mgt. improvements, measurement of key indicators; quality mgt leader; cross functional teams and coordination, policy setting and review, flowchart of policy mgt and relation with daily mgt.

**Unit 2**

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

**Unit 3**

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

**Unit 4**

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

**Unit 5**

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

**Suggested Books:**

**1.** Gitlow HS, Oppenheim et al; Quality Management;TMH
**2.** Gryna FM; Juran's Quality Planning and Analysis;TMH
**3.** Crosby Philips; Quality is still free; New AmerLibrary
**4.** Kulkarni VA and Bewoor AK; Quality Control;Wiley
**5.** Jankiraman B and Gopal RK; Total Quality Management- Text and Cases; PHILearning
**6.** Sugandhi L and Samual A; Total Quality Management; PHILearning
**7.** Subburaj R; Total Quality Management;TMH
**8.** Naidu Babu and Rajendran; TQM; New age Internationalpub;
**9.** Chase Richard B et al; Operations management;SIE-TMH
**10.** Chary SN; Production and Operations Management; TMH12

# Uttarakhand Technical University, Dehradun

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**Plastic and Polymer Engineering, V-Semester**

| **BMET- 505 (C) Innovation and Entrepreneurship** | **L** | **T** | **P** |
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| | **3** | **0** | **0** |

**Objectives:**

1. Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurialactivities
2. To develop the ability of analyzing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.
3. Develop the ability of analyzing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development and, finally, to contribute to their entrepreneurial and managerialpotentials.

**Course Outcome:**

1. Key concepts underpinning entrepreneurship and its application in therecognition and exploitation of product/ service/ processopportunities
2. Key concepts underpinning innovation and the issues associated with developing and sustaining innovation withinorganizations
3. How to design creative strategies for pursuing, exploiting and furtherdeveloping newopportunities
4. Issues associated with securing and managing financial resources in new and establishedorganizations

**Detailed Content:**

**UNIT 1:** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT 2:** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT 3:** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity

**UNIT 4:** Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs andAgencies.

**Suggested Books:**


1. Khanka. S.S., "Entrepreneurial Development" S.Chand& Co. Ltd.,Ram Nagar, New Delhi,2013.
2. Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning2014.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill,2013.
4. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech,2005.
5. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press,2011.
6. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad,1986.

# Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

**Plastic and Polymer Engineering, V-Semester**

| BPPP-506 | Synthesis and Polymerization Lab | L | T | P |
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## SYNTHESIS & POLYMERIZATIONLAB

**Objectives:**

**1.**Understand the synthesis and polymerization of various thermoplastic and thermoset materials using different polymerization techniques.
**2.** Interpret the topography of Developed polymer and testing of new polymer**.**
**3.** Understand theSynthesis of polymers based on any common monomers.

**Course Outcome:**

1. Understand the method, equipment's used for synthesis of various thermoplastics and thermosetting polymers and precautions to be during their synthesis.
2. Synthesize desired thermoplastics and thermosetting polymers.
3. Develop new polymers and chemically modify the existing polymers based on specific property requirements.

**Suggested Experiments:**

**Minimum 8 Experiments**

1. Suspension polymerization ofStyrene/MMA.
2. Preparation and testing of UF/PF/MFresins.
3. Preparation and testing of Diglycidyl ether of bis phenol-A(DGEBA).
4. Bulk and solution polymerization of MethylMethacrylate/Styrene.
5. Emulsion polymerization of Styrene/ MethylMethacrylate.
6. Copolymerization of styrene & MMA and determination of reactivityratios.
7. Preparation of Poly(vinylbutyral).
8. Preparation of unsaturated polyester resin & determination of its acid value.
9. Preparation of saturated polyester resin and determination of its acid value.
10. Synthesis of copolymers based on any common monomers like styrene,acrylates.