

sub code:16SCCAF7

**DEPARTMENT OF APPAREL AND FASHION TECHNOLOGY**

**TECHNICAL TEXTILES**

**UNIT 1**

**PART A**

**1. Define Technical textiles**

A technical textile is a textile product manufactured for non-aesthetic purposes, where function is the primary criterion. Technical textile materials are most widely used in filter clothing, furniture, hygiene medicals and construction material.

**2. Mention any two properties of Technical textiles**

The essential properties required are strength, elongation, stiffness, bio-degradation, resistance to sunlight and resistance to toxic environment.

**3. What are Technical textiles used for?**

Technical textiles are fibres & fabrics which have been developed for their performance, and functional properties. Here are just a few examples: Super absorbent medical textiles used in wipes, wound dressings & nappies. X-Static® is the name of new yarn which uses silver in its production.

**4. How are technical textiles made?**

A technical textile can be woven or non-woven and combinations of both. It can be made up as a single or multiple-layer and can be produced as a composite or a coated and/or impregnated material. It can be made from any fibre yarn or filament of purely natural or synthetic origin or combination of the two types.

**5. Which fibre is used as armour material?**

Kevlar

**PART B**

**1. Give the scope and types of technical textiles.**

**Scope of Technical Textile:**

An exceptional feature of technical textiles is the use of innumerable varieties of raw materials, processes, products and applications for their production. Some of the materials used for making technical textile are listed below.

Metals, like steel.

Minerals, like asbestos and glass.

Synthetic polymers, like PES, PA, PAN, PP etc.

Regenerated fibers like rayon fiber and acetate fiber.

Natural fibers like cotton fiber, jute fiber, wool fiber etc.

### **Types of technical textiles:**

Agrotech, Industrial tech, Cloth tech, Home tech, Med tech, Oeko tech, Pack tech, Sport tech.

## **2. What are the fibres used in technical textiles?**

### 1. Glass fibre

Glass fibre is obtained from the fine fibres of the glass. Fibre glass is formed from fine silica strands.

### 2. Viscose fibre

Viscose rayon is a cellulosic fibre, which is manufactured by regeneration. It is neither a synthetic fibre nor a natural fibre

### 3. Acrylic fibre

Acrylic fibre is a synthetic fibre, which is made from polymer.

### 4. Protein fibre

Protein fibre is available in chitin and chitosan form

### 5. Metal fibre

Metallic fibre is used in all kinds of clothes from everyday wear to party wear and evening wear. Metallic fibre is commonly used in upholstery.

## **3. What are the properties of technical textiles?**

Primary properties of textile fibres: High length to width ratio, Tenacity, Flexibility, Spinning quality. Secondary properties of textile fibres: Physical shape, Elastic recovery and elongation, Resiliency.

secondary properties also include moisture absorption characteristics, fiber resiliency, abrasion resistance, density, luster, chemical resistance, thermal characteristics,

#### **4. Write about filtration textiles reinforcement**

Fabric structure determines the physical properties of the filters. Air permeability is related to the pore size, fibre length and diameter. Reinforcing material changes the pore sizes of filters. The filtration efficiency increases as the pore size of the filter decreases

### **PART C**

#### **1. Explain in detail note on fabric structure in technical textiles.**

A woven fabric which is used in clothing and garments or for decoration and covering purposes. Without these application woven fabric also used as sportswear, medical applications, textiles for electronics and airbag construction in automotive engineering.

Medical textiles are the products and constructions used for medical and biological applications for clinical and hygienic purposes, scaffolds for tissue culturing and a large variety of prostheses for permanent body implants.

Protective and healthcare textiles – surgical wear, operation dresses, staff uniforms, etc.

External devices – wound dressings, bandages, pressure gauze, prosthetic aids, etc.

Implantable materials – sutures, vascular grafts and artificial limbs are the products where textiles are used.

Hygiene products – incontinence pads, nappies, tampons, sanitary towels, etc.

Extracorporeal devices – artificial liver, artificial kidneys and artificial lung are the recent advances in medical textiles.

#### **Automotive textiles :**

Automotive textiles are finding extensive use in the product categories of interior trims, safety devices such as seatbelts and airbags, carpets, filters, battery separators, hood liners, hoses and belt reinforcement.

Woven fabric structure is the main considering points of woven fabric production. ... Woven fabric is produced by interlacing two sets of yarns, the warp and the weft, which are at the right angle to each other in the plane of the fabric.

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## **UNIT 2**

### **PART A**

#### **1. What are medical textiles?**

Medical textiles are textile products and constructions for medical applications. ... Depending upon the usage, the medical textiles are classified as Healthcare and Hygiene products, Extracorporeal devices, Implantable materials and Non-implantable materials.

#### **2. What are extra corporeal device?**

An extracorporeal is a medical procedure which is performed outside the body.

Used as a heart-lung machine used to oxygenate the blood during surgery.

#### **3. What should be in a survival bag?**

Tools, Multi-tool, Pocket knife, Pliers, Illumination, Flashlight, Two sets of extra batteries, Emergency candles, Water Purification Tablets, Cordage and Tape, Duct tape, 200 feet of Paracord, Fire-Starting Kit, Flint or magnesium Firestarter, Matches, Metal Pot or Mugs, Space Blanket, Emergency Poncho.

#### **4. What are medical implants made of?**

Medical implants are man-made devices, in contrast to a transplant, which is a transplanted biomedical tissue. The surface of implants that contact the body might be made of a biomedical material such as titanium, silicone, or apatite depending on what is the most functional.

#### **5. What materials are used in plastic surgery?**

There are even more options for material choices available to plastic surgeons depending on the type of procedure, but the most common ones used are silicone, Gore-Tex, and Med-Por. Silicone is the most common type of material used for implants and has been used in plastic surgery for decades.

## **PART B**

### **1. Why are these materials used in medical implants?**

#### **SURGICAL MESH**

Surgical mesh is made from both inorganic and biological materials which are loosely woven together to form a sheet. These sheets can be used as either temporary or permanent support for organs or various other tissues during surgery. It is most commonly used for hernia or gynaecological repair. Permanent versions of the mesh can stay in the body forever whereas temporary ones often dissolve away. The material has been in the news recently as, like with many materials used in medical implants,

#### **SILICONE**

Silicone gel is an inert polymer which causes no known human allergies or reactions. The material is usually heat-resistant and can be liquid or rubber-like in texture. It is well-known for being used to make breast implants for reconstructive surgeries and is often chosen over saline breast implant options despite the higher risks should leakage of silicone into the body occur

### **2. Explain about implantable materials in medical textiles.**

Implantable medical textile products are also more critical than those disposable medical textile products used outside the human body. Furthermore, implantable medical textile products require great technical sophistication and demand because of the safety, biological complexity and challenges of the human body,

A suture by definition is a strand of textile material, natural or synthetic, used to ligate blood vessels and to sew tissues together. It consists of a fiber with a metallic needle attached at one of the fiber ends. An ideal suture should:

- Handle comfortably and naturally.
- Show minimum tissue reaction.
- Have adequate tensile strength and knot security.
- Be unfavorable for bacterial growth and easily sterilized.
- Be nonelectrolytic, noncapillary, nonallergenic and noncarcinogenic.
- Have low memory effect for easy handling and better knot security

### **3. What are the properties of medical implants?**

They should have biomechanical properties comparable to those of autogenous tissues without any adverse effects. The principal requirements of all medical implants are corrosion resistance, biocompatibility, bio-adhesion, biofunctionality, processability and availability

#### **4. Write notes on survival textile**

**Sleeping bag fabric:** The outer shell of a backpacking bag is typically made of a ripstop nylon or polyester. Many shell fabrics are also treated with a durable water repellent (DWR) finish to prevent moisture from soaking through and dampening the fill.

A tent is a shelter consisting of sheets of fabric or other material draped over, attached to a frame of Tents, Camping equipment, Portable buildings and shelters, Survival skills.

A glove is a garment covering the whole hand. Gloves usually have separate sheaths or openings

### **PART C**

#### **1. Give an account on various product produced by implantable materials in the field of medical textiles.**

Implantable medical textiles is that the materials are use in effecting to the body if it is wound closure (sutures) or replacement surgery like vascular graft and artificial ligaments. There are many shapes and sizes, for duplications as found in human body.

#### **Sutures**

1. biodegradable
2. non biodegradable

#### **Soft tissue implants**

1. artificial tendon
2. artificial ligament
3. artificial cartilage
4. artificial skin
5. eye contact lenses

#### **Orthopaedic implants**

1. artificial joints or bones

## Cardiovascular implant

1. vascular graft

2. Heart valves

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## UNIT 3

### PART A

#### 1. What is geo textile?

Geotextiles refers to a permeable synthetic textile material. Generally it is produced from polyester or polypropylene polymers. Geotextiles are used to increase soil stability, provide erosion control or aid in drainage.

#### 2. What is the use of geotextile?

Geotextiles can be used in so many ways. They are used as soil separators, used in filtration and drainage, used as a reinforcement material to increase the stability of earth mass, used for the control of erosion, etc

#### 3. What is the main function of geotextile?

**Functions:** separation, filtration, drainage, reinforcement, sealing and protection.

#### 4. Mention any two essential properties of geotextiles.

**Physical properties:** specific gravity. weight. thickness.

**Mechanical properties:** tenacity. tensile strength.

**Hydraulic properties:** porosity. permeability. permittivity.

**Degradation properties:** biodegradation. hydrolytic degradation.

**Endurance properties:** elongation.

#### 5. List out the natural fibres used in geotextiles

The commonly used natural fibers are:

Poly amides

Polyesters

Polyethylene

Polypropylene

Polyvinyl chloride

Ethylene copolymer bitumen

Chlorinated poly ethylene

## **6. What is membrane?**

Geotextile membranes are usually a non-woven fabric or material which allow water to pass through freely but stops debris or organic material from penetrating

## **PART B**

### **1. Explain about the types and uses of geotextiles.**

Geotextiles are made up of polymers such as polyester or polypropylene. They are divided into 3 categories on the basis of the way they are prepared :

#### **1) Woven Fabric Geotextile**

Commonly found geotextiles are of the woven type and are manufactured by adopting the techniques which are similar to weaving usual clothing textiles.

#### **2) Non-Woven Geotextile**

Non-woven geotextiles are manufactured from either continuous filament yarn or short staple fiber. The bonding of fibers is done using thermal, chemical or mechanical techniques or a combination of techniques.

#### **3) Knitted geotextile**

Knitted geotextiles are manufactured by the process of interlocking a series of loops of yarn together.

### **2. Give the role of textiles in aircraft and Marine application.**

Kevlar fibres are known for the ability to provide quality and consistency, which are critical for aerospace applications. Kevlar fabrics are used in containment wraps, which perform the important role in preventing the broken engine blades from damaging the aircraft or entering the compartment by the passengers



### **3. Elaborate the use of textile in railways and cars.**

Textiles are used in the construction of automobiles, railways, ships, aircraft and spacecraft. Nylon gives strength and its bursting strength being high is used as air bags in cars. Carbon composites are mostly used in the manufacture of aeroplane parts while carbon fibre is used for making higher end tyres.

### **4. What are the natural fibres in geo textiles?**

Natural fibers in the form of paper strips, jute nets, wood shavings or wool mulch are being used as geotextiles. In certain soil reinforcement applications,

They are generally used for prevention of soil erosion until vegetation can become properly established on the ground surface. The commonly used natural fibers are:

**Ramie:** These are subtropical bast fibers, which are obtained from their plants 5 to 6 times a year. The fibers have silky luster and have white appearance even in the unbleached condition. They constitute of pure cellulose and possess highest tenacity among all plant fibers.

**Jute:** This is a versatile vegetable fiber which is biodegradable and has the ability to mix with the soil and serve as a nutrient for vegetation.

It is possible to manufacture designed biodegradable jute geotextile, having specific tenacity, porosity, permeability, transmissibility according to need and location specificity. Soil, soil composition, water, water quality, water flow, landscape etc.

### **5. Write short notes on essential properties of geotextile.**

There are three main properties which are required and specified for a geotextile are its mechanical responses, filtration ability and chemical resistance.

#### **Mechanical properties:**

tenacity

tensile strength

bursting strength

drapability

compatibility

flexibility

tearing strength

frictional resistance

Some of the basic properties of Geotextile include filtration, separation, protection, reinforcement and also drainage. It has multiple functionality like flexible thickness .

## **PART C**

### **1. What are the applications of textiles in geotech**

#### **separation?**

Geotextiles function to prevent mutual mixing between 2 layers of soil having different particle sizes or different properties.

#### **Drainage**

The function of drainage is to gather water, which is not required functionally by the structure, such as rainwater or surplus water in the soil, and discharge it.

#### **Filtration**

Filtration involves the establishment of a stable interface between the drain and the surrounding soil. In all soils water flow will induce the movement of fine particles. Initially a portion of this fraction will be halted at the filter interface;

#### **Reinforcement**

Due to their high soil fabric friction coefficient and high tensile strength, heavy grades of geotextiles are used to reinforce earth structures allowing the use of local fill material.

#### **Protection**

Erosion of earth embankments by wave action, currents and repeated drawdown is a constant problem requiring the use of non-erodable protection in the form of rock beaching or mattress structures.

### **2.Elaborate on technical textile in transportation.**

Transportation is the largest user of technical textiles. It is about 23% of the total technical textiles market. However, in India its share is 7 % in technical textiles market. Textiles provide a means of decoration and a warm soft touch to surfaces that are necessary features for human well being and comfort, but textiles are also essential components of the more functional parts of all road vehicles, trains, aircraft and sea vessels.

### **Applications of Transportation Textiles:**

Upholstery, car interior, carpets

Tires, car elements, filters

Heat, cable & sound insulation

Safety systems - airbags, seat belts

Protective covers for land crafts, boats, aircrafts

Sailcloth, inflatable boats

Envelopes of balloons

Special equipment for mil

Technical textiles that are used in this automotive or transport sector are called “MOBILTECH.”

Some of the applications in this industry are:

Air bag fabrics

Fabric used as a basis for reduction in weight of body parts

Tyre cord fabrics

Automotive upholstery and other textile fabrics used inside the vehicle

Engine (radiator hoses, power steering, hydraulic lines, filters etc)

Composites for body and suspension parts (bumpers, wheel covers, door handles etc)

Comfort and decoration (seating, carpets, interior decoration)

Safety (seat belts, air bags, seat fire barriers etc)

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## **UNIT 4**

### **PART A**

#### **1. What is the purpose of environmental protection?**

Protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property.

2. How can we protect our environment

Reduce, reuse, and recycle. Cut down on what you throw away.

Volunteer. Volunteer for cleanups in your community.

Educate.

Conserve water.

Choose sustainable.

Shop wisely.

Use long-lasting light bulbs

Plant a tree

### **3. What is thermal insulation?**

It is the process of insulating against transmission of heat material of relatively low heat conductivity used to shield a volume against loss or entrance of heat by radiation, convection, or conduction.

### **4. What is camouflage?**

Camouflage, also called cryptic coloration, is a defense or tactic that organisms use to disguise their appearance, usually to blend in with their surroundings. Organisms use camouflage to mask their location, identity, and movement.

### **5. Define concealment**

Concealment is the state of being hidden or the act of hiding something. The criminals vainly sought concealment from the searchlight.

### **6. What is ballistic protection?**

Ballistic protection involves protection of body and eyes against projectiles of various shapes, sizes, and impact velocities

## **PART B**

### **1. Why is environmental protection important**

Environmental Conservation is important because when we protect the environment, we are not protecting some distinct, distant entity but ourselves. Right to Life and Right against Exploitation are Fundamental Rights of all organisms dwelling on Earth.

Healthy ecosystems clean our water, purify our air, maintain our soil, regulate the climate, recycle nutrients and provide us with food. They provide raw materials and resources for medicines and other purposes.

## **2. What is difference between camouflage and concealment?**

Healthy ecosystems clean our water, purify our air, maintain our soil, regulate the climate, recycle nutrients and provide us with food. They provide raw materials and resources for medicines and other purposes.

Camouflage, also called cryptic coloration, is a defense or tactic that organisms use to disguise their appearance, usually to blend in with their surroundings. Organisms use camouflage to mask their location, identity, and movement.

## **3. List out the properties of productive textiles**

There are some key characteristics of protective clothing which are listed in the following:

Lightweight and low bulk

High durability and dimensional stability

Water repellent

Windproof and snow shedding

Thermal insulating

Ultra violet (UV) resistant

Air permeability

Flame retardant

## **4. What are protective textiles?**

There are mainly 15 types of protective clothing used;

High-temperature protective textiles

Chemical protective textiles

Mechanical protective textiles

Flame-resistant protective textiles

Ultra Violet protection finish

Metalized fabrics

High visibility textiles

Radiation protective textiles

Protective health care garments

Clean room technology

Biological protective textiles

Ballistic protective textiles

Space suits

Breathable fabrics

Electrical protective textiles

### **5. Write short notes on ballistic protection materials**

Ballistics protection typically comprise ceramic armor plates, for example, boron nitride, tungsten carbide, tungsten disulfide, aluminum nitride, and so forth, coated or contained in high-modulus organic polymers, such as para-aramids, for example, Kevlar and Twaron,

### **6. Write a note on insect repellent textiles**

A mosquito repellent finish can be applied to the textile material either by natural or chemical repelling agents.

Mosquito Repellent Finish of Cotton Fabric by Extracting Castor Oil. Malaria is ranked as the leading infectious disease in Ethiopia. Control of mosquitoes is something of utmost importance

...

This form of natural extraction of the mosquito repellent finishes is very safe and ecofriendly and protect the body from mosquitoes. The sample treated with mint leaves extract is effective, economical and eco-friendly

## **PART C**

## **1. Write a detailed note on flame and heat protective textiles and their uses**

Protective textiles are a part of technical textiles that are defined as comprising all those textile-based products which are used principally for their performance or functional characteristics rather than their aesthetic or decorative characteristics.

Protech is an ensemble of textile products and related material used in the manufacture of various protective clothing for personnel working in hazardous environment

Protective and safety textile forms are considered as technical textiles. Nonwovens can be developed to fulfil a range of protective functions including protection against chemicals, micro-organisms, radioactivity, moisture and cold, heat, fire and flame, and physical attack.

Ballistic protection is a class of protective clothing, which aims at protecting the individuals from the bullets and steel fragments from hand-held

In the technical textile application, fabrics that have good flame resistance properties are mostly made of synthetic fibres such as glass, carbon and aramids.

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## **UNIT 5**

### **PART A**

#### **1. Define degradation**

It occurs when earth's natural resources are depleted and environment is compromised in the form of extinction of species, pollution in air, water and soil, and rapid growth in population.

#### **2. What is meant by environmental degradation?**

Environmental degradation is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems; habitat destruction; the extinction of wildlife; and pollution. ... When natural habitats are destroyed or natural resources are depleted, the environment is degraded.

#### **3. Define pollution**

Pollution is the introduction of contaminants into the natural environment that cause adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light.

#### **4. What is harm reduction.?**

Harm reduction refers to policies, programmes and practices that aim to minimise negative health, social and legal impacts associated with drug use, drug policies

### **5. Name some examples of harm reduction**

Harm reduction programs exist for several types of drugs, including opioids, alcohol, stimulants, Ecstasy, and marijuana. They range from needle exchange sites to managed alcohol programs to drug-testing kits at music festivals

### **6. What is resource depletion?**

Resource depletion is the exhaustion of raw materials within a region. Resources are commonly divided between renewable resources and non-renewable resources. Use of either of these forms of resources beyond their rate of replacement is considered to be resource depletion.

## **PART .B**

### **1.How does textile industry cause pollution?**

Air pollution caused by the textile industry is also a major cause of concern. Boilers, thermo pack, and diesel generators produce pollutants that are released into the air. The pollutants generated include Suspended Particulate Matter (SPM), sulphur di oxide gas, oxide of nitrogen gas, etc.

### **2. What kinds of pollution to textile factories give off?**

#### **Water Pollution**

The toxic chemicals used to create textiles are major sources of pollution from textile factory operations. Factories use polyvinyl chloride to size fabrics, chlorine bleach to lighten a fabric's color, benzidine and toluidine as dyeing agents and flame retardants that are known cancer-causing agents

#### **Air Pollution**

As textiles move through the production process, numerous life-threatening pollutants left untreated can contaminate the air.

#### **Solid-Waste Pollution**

Textile manufacturing operations create large amounts of toxic and nontoxic solid waste. Fibers, hemp, yarn and fabrics are solid waste that are created directly from production lines.

### **3. Write short notes on textile dye water pollution**



Wastewater from textile dyeing is a huge pollutant around the world. Some dyes don't ever degrade in water. Wastewater from textile dyeing also affects plant life in the water,

Textile dyes are substances used to color fabrics. The dyes soak into the fabric and change it chemically, resulting in color that stays permanently through repeated use. Today, more than 10,000 substances are classified as textile dyes, and different kinds of dyes work better on specific kinds of fabric.

#### **4. How can resource depletion be reduced?**

Make Electricity Use More Efficient.

Use More Renewable Energy.

Promote Sustainable Fishing Rules.

Avoid Single-Use Plastics.

Drive Less.

Recycle More and Improve Recycling Systems.

Use Sustainable Agriculture Practices.

Reduce Food Waste.

### **PART.C**

#### **1. How does resource depletion effect the environment?**

Natural resources exploitation, exploration, mining and processing have caused different types of environmental damages which include ecological disturbances, destruction of natural flora and fauna, pollution of air, water and land, instability of soil and rock masses, landscape degradation, desertification and global ..

#### **Effects of Resource Depletion**

Air pollution

Health effects

Global warming

Loss of forests

Extinction of animals and plants

Depletion of elements and minerals

Water shortages

Oil shortages

### **Air pollution**

Resource depletion can have significant adverse effects on our air quality. For example, deforestation leads to a higher level of air pollution. Trees naturally absorb a certain amount of harmful gases and turn them into oxygen.

### **Health effects**

Resource depletion also indirectly contributes to severe health effects. Since resource extraction causes air pollution, it can in turn cause health issues like lung cancer or other diseases.

### **Global warming**

Resource depletion also contributes to global warming in a significant way. By processing natural resources, harmful gases are emitted into the air.

### **Loss of forests**

Resource depletion, in particular logging and deforestation, lead to a loss of forests. This problem is especially severe in the Amazonian Rainforest

### **Extinction of animals and plants**

Another related topic is the loss of many animals and plants due to deforestation and other extraction processes. By extracting resources, we usually destroy the environment of a variety of animals and plants

### **Depletion of elements and minerals**

If the extraction rate of natural resources stays on the levels we currently face, it is quite logical that many precious materials and elements will be entirely depleted in the near future.

### **Water shortages**

Water shortage will become a quite severe problem in the near future. Due to industrial processes and the inappropriate disposal of waste, rivers and lakes have already been polluted in a severe way

### **Oil shortages**

Oil is used for many industrial purposes. All things made of plastic have been manufactured from oil. Moreover, oil is also needed when it comes to the production of fossil fuels. The fuel for our cars is produced through the processing of oil

### **Gas shortages**

Similar to oil, gas is also used for many industrial purposes and also for heating purposes for our houses.

### **Economic effects**

Apart from the ecological effects, resource depletion also has serious economic effects. The price for goods, including natural resources, is determined through supply and demand on the world market