

# NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR



## BIOMEDICAL ENGINEERING

### ASSIGNMENT

# **Solutions to Covid-19 Provided By Biomedical Engineers**

*Submitted By:*

Name : MB Sai Krishna

Roll No. : 21111027

Semester : First

Branch - Biomedical

Engineering

*Under The Supervision Of:*

Dr. Saurabh Gupta

Department Of Biomedical

Engineering

NIT Raipur

# Introduction

Due to the specific obstacles highlighted by epidemiologists, immunologists, and medical practitioners, biomedical science and engineering have been proposed as promising areas to assist medical science in combating SARS-CoV-2. Survival, symptomology, protein surface composition, and infection pathways are all factors to consider. Design is based on these multidisciplinary technical concepts to research and create techniques of prevention, diagnoses, monitoring, and therapies.

## 1 Disinfecting N-95

The Ministry of Science and Technology announced on Friday that a group of Indian scientists has created a self-disinfecting antiviral mask to combat the Covid-19 outbreak.

According to the ministry, the antiviral mask coated with copper-based nanoparticles performs effectively against coronavirus and other viral and bacterial illnesses.

The mask is biodegradable, washable, and highly breathable.

Because the virus is transmitted mostly by respiratory particles that are airborne, wearing a mask has been one of the most significant and successful health precautions to contain it. The ministry did highlight, however, that preventing viral transmission with traditional masks has proven challenging, particularly in densely populated areas such as hospitals, airports, train stations, and shopping malls, where the virus load is quite high.

## 2 3-D printing Mask

We show that employing a low-cost 3D-printed frame to improve the fit of a fabric mask improves its inward protection efficacy for airborne particles known to transmit SARS-CoV-2. In comparison to the effectiveness attained in the absence of the frame, a 3D-printed flexible frame (i.e., brace) boosted the inward protection efficiency of a cotton-based fabric mask by 13–43 percent for particles ranging in size from 0.5–2  $\mu$ m. The introduction of a flexible form-fitting frame, for example, boosted inward protection efficacy by 31 and 40 percent for 0.5 and 1  $\mu$ m particles, respectively. For optimising the facial

contact area and mechanical matching, rapid prototyping of the mask frame geometry and material properties was also highlighted

### **3 Surface Decontamination**

In addition to recommended PPE for caregivers and patients, hand hygiene and surface decontamination are also key to health safety, as the SARS-CoV-2 is known to remain viable on surfaces for hours to days. Disinfection practices should be focused on meticulous hygiene in workspaces to minimize contaminated surfaces. As mentioned previously, the nosocomial spread has been documented for infectious pathogens, including coronaviruses. The multifunctionality of nanomaterials endow them with the feasibility of being coated on a large number of common In addition to being cost-effective and easy to synthesize, copper oxide (CuO) NPs exhibit interesting biological properties. For these reasons, they have been incorporated successfully for microorganism and virus inactivation purposes on contaminated surfaces. Thus, CuO NPs will play an important role to promote the risk reduction of people exposed to the COVID-19 virus spread. surfaces to act as biocidal agents for different types of pathogens, including viruses

### **4 Continuous Positive Airway Pressure (CPAP)**

The next step up in treating COVID-19 patients is Continuous Positive Airway Pressure (CPAP) which is initially intended to prevent airways collapse in sleep apnoea patients, but has been shown to be beneficial to COVID patients if applied early enough in the progression of the disease. A well-fitted face mask is an essential component of a CPAP system and as such it is quite intrusive. CPAP is only appropriate for patients who are capable of some breathing strength as CPAP effectively opposes some resistance to expiration. Variants exist that either automatically adjust the level of pressure to the patients breathing characteristics (APAP) or have different levels of pressure for inspiration and expiration (BiPAP). CPAP usually supplies (filtered) air to the patient but most masks have a port for supplementing the supply with oxygen.

## 5 VENTILATORS

Patients who are unable to breathe on their own must be placed on a ventilator. Patients in an advanced stage of respiratory distress are frequently intubated and sedated at the start of treatment since ventilators can replace breath function. Patients in an advanced stage of respiratory distress are frequently intubated and sedated at the start of treatment since ventilators can replace breath function. They are complicated devices that give healthcare providers a lot of flexibility in terms of adjusting assisted breathing settings and eventually weaning healing patients off the ventilator. Modern ventilators are usually pressurecontrolled closed loops that can detect spontaneous breathing and provide synchronised aid to recovering patients. They also allow the patient to alter the composition of the gas he or she breathes, ranging from regular air to 100 percent oxygen. They normally get their supply from the hospital's gas supply network, but they can also be connected to oxygen tanks or oxygen concentrators if there isn't one.