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S. No. of Question Paper : 5298

Unique Paper Code : 3184002004

Name of the Paper : Pandemic Challenges and Preparedness (GE)

Name of the Course : B.Sc. (Hons.) Biomedical Science (NEP 2020)

Semester : II

Duration : 3 Hours

Maximum Marks : 90

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt five questions in all.

Question No. 1 is compulsory.

Give illustrations and examples wherever required.

Subparts of the questions should be attempted together

1. (a) Provide one word for the following statements (any six) : 6×1=6
- (i) A disease outbreak that spreads across countries or continents.
 - (ii) The protein shell surrounding a virus.
 - (iii) The therapy that uses antibodies from recovered patients.
 - (iv) The isolation of infected individuals to prevent disease spread.
 - (v) The process of stimulating immunity through injections.
 - (vi) The laboratory technique used to *in vitro* amplify the DNA.

P.T.O.

(vii) The continuous monitoring of diseases.

(viii) The test that detects antibodies in blood.

(b) Justify the following statements as true or false (any *four*) : $4 \times 3 = 12$

(i) Covid-19 is caused by a bacterium.

(ii) HIV primarily attacks the immune system.

(iii) Zinc is an essential mineral for immune function.

(iv) Wearing a mask does not reduce virus transmission.

(v) Live attenuated vaccines contain dead viruses.

(vi) RT-PCR is used to detect viral RNA.

(vii) Standard Operating Procedures (SOPs) are not required for pandemic management.

2. (a) Differentiate between the following (any *four*) : $4 \times 3 = 12$

(i) Epidemic and Pandemic.

(ii) Antigenic Drift and Antigenic Shift.

(iii) Placebo Effect and Active Treatment.

(iv) Handwashing with soap and use of sanitizers.

(v) Global Health Approach and National Health Strategies.

- (b) A pandemic affects 500,000 people, and 25,000 die from the disease. Calculate the Case Fatality Rate (CFR). If a new variant increases deaths to 40,000, what is the percentage increase in CFR ? 6

3. (a) Explain the following concepts : 3×5=15

- (i) Factors that determine whether a disease outbreak would become an epidemic or a pandemic.
 - (ii) Some pathogens more virulent than others.
 - (iii) Risks associated with self-medication using alternative therapies during a pandemic.
 - (iv) Mutations in viral genomes contribute to the emergence of new strains.
 - (v) Herd immunity protects unvaccinated individuals in a population.
- (b) Why is RT-PCR considered the gold standard for viral detection despite the availability of faster tests ? 3

4. (a) Match the following :

8×1=8

Column A

Column B

- | | |
|--------------------------------|---|
| (1) Black Death (Plague) | Affects immune system by targeting CD4+ T cells |
| (2) Mycobacterium tuberculosis | Caused by <i>Yersinia pestis</i> and spread by fleas |
| (3) Influenza virus | Causes a disease with latent infection ability |
| (4) SARS-CoV 2 | Undergoes antigenic shift and drift |
| (5) Plasmodium falciparum | Uses spike (S) protein for host cell entry |
| (6) Rabies virus | Responsible for cerebral malaria |
| (7) SARS (2002-03) | 100% fatal once symptoms appear |
| (8) HIV/AIDS | Zoonotic virus suspected to originate from civet cats |

(b) Sequence the events for the following processes :

3½, 3½

(i) Sequence the events in the spread of a pandemic :

- (1) Localized outbreak in a community.

- (2) Zoonotic spillover of pathogen from animals to humans.
 - (3) WHO declares a global pandemic.
 - (4) Human-to-human transmission escalates.
 - (5) Cases are reported internationally.
 - (6) Governments implement lockdowns and travel restrictions.
 - (7) Vaccination campaigns and herd immunity development.
- (ii) Sequence the stages of vaccine development and approval :
- (1) Preclinical testing in animal models.
 - (2) Phase-1 clinical trial (small group testing for safety).
 - (3) Regulatory approval from agencies like FDA/WHO.
 - (4) Phase-2 clinical trial (larger group testing for immune response).
 - (5) Mass vaccination campaigns and post-market surveillance.
 - (6) Large-scale vaccine production and distribution.
 - (7) Phase-3 clinical trial (widespread testing for efficacy and safety).

- (c) A bacteria doubles every 30 minutes. If you start with 1,000 bacteria, how many will there be after 3 hours ? 3
5. (a) Suppose you are investigating how population density affects the spread of pandemics. How would you design an epidemiological study to test this ? 7
- (b) How did globalization and international travel contribute to the rapid spread of COVID-19 compared to historical pandemics like the Spanish Flu ? 7
- (c) Identify the odd one out and explain your choice : 4
- (1) Global surveillance
 - (2) Vaccine development
 - (3) Climate change
 - (4) Rapid diagnostic kits
6. (a) An N95 mask filters out 95% of airborne particles. If an environment has 2,000 virus particles per cubic meter of air, how many will be inhaled per cubic meter while wearing an N95 mask ? 6

- (b) How does Covaxin differ from Covishield in its mechanism of action ? 6
- (c) A vaccine has a 0.02% chance of causing severe side effects: If 5 million people receive the vaccine, how many cases of severe side effects are expected ? 6

