※ 考生請注意：本試題 □可 ☑不可 使用計算機

I. 選擇題（60%，每題 5 分）

1. A sand spit formed between an offshore island or rock and the mainland is called a(n)
   A. offshore spit. B. inshore spit. C. barrier spit. D. sandbar. E. tombolo.
2. A beach that is fed by mixed sizes of rocks and particles but shows only large rocks on its surface is
   A. an erosional beach. B. subjected to high waves and strong currents. C. an armored beach. D. All of these are correct. E. None of these are correct.
3. Using equilibrium tidal theory, the tide may be considered a wave with a wavelength approximately
   A. the diameter of Earth. B. half the diameter of Earth. C. the circumference of Earth. D. half the circumference of Earth. E. the radius of Earth.
4. ___ tides occur at the first quarter moon.
   A. Mixed B. Diurnal C. Semidiurnal D. Neap E. Spring
5. The restoring force of a fully developed wind wave is
   A. gravity. B. solar heat. C. density. D. surface tension. E. viscosity.
6. A group of waves is propagated at a speed that is _____ the speed of the individual waves in deep water.
   A. twice B. the same as C. one-half D. one-quarter E. one-tenth
7. In the Northern Hemisphere, the water surface of the open ocean moves
   A. at right angles to the wind. B. against the wind. C. parallel to the wind. D. 45 degrees to the right of the wind. E. 45 degrees to the left of the wind.
8. A rapid change in temperature with depth is called a
   A. halocline. B. thermocline. C. photic level. D. midwater current. E. pycnocline.
9. Which statement(s) about El Niño is(are) true?
   A. It produces warm surface water along the Peru-Ecuador coast.
   B. It interrupts the southeast tradewinds and displaces the doldrums.
   C. It is associated with a displacement of the jet stream.
   D. It is also known as La Niña.
   E. It produces warm surface water along the Peru-Ecuador coast, it interrupts the southeast tradewinds and displaces the doldrums, and it is associated with a displacement of the jet stream are true.
10. The sofar channel is centered where sound velocity
    A. increases with depth. B. decreases with depth. C. is at its minimum. D. is at its maximum. E. None of these are correct.
11. The deepest depth of the oceans is located in which trench?
    A. Japan-Kuril B. Aleutian C. Peru-Chile D. Puerto Rico-Cayman E. Mariana

(背面仍有題目,請繼續作答)

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12. One degree of latitude is about equal to
A. 1 nautical mile. B. 1 land mile. C. 60 nautical miles. D. 60 land miles. E. 600 nautical miles.

II. 簡答題（40 %，每題 10 分）

1. (a)寫出適用於微小振幅波浪的頻散關係（dispersion relation），並說明其物理意義；(b)在深水波（deep-water waves）的情形下，簡化上述頻散關係，並求出波速；(c)在淺水波（shallow-water waves）的情形下，簡化上述頻散關係，並求出波速；(d)若考慮表面張力的影響，則(a)中之頻散關係，應如何修正？

2. 假設一波浪的水位可以下列數學式子表示，
$$\eta=\frac{H}{2}\cos(kx-\omega t)+\frac{H^2k}{16}\frac{\cosh kh}{\sinh^3 kh}(2+\cosh 2kh)\cos 2(kx-\omega t)$$
則此波浪與微小振幅波之差異為何？其波速(wave celerity)為何？在淺水波的情況下，上式的限制為何？

3. 海平面上升，一般而言，會加劇海岸的侵蝕，請說明其理由。

4. 就你所知，詳細討論在台灣海域如何利用海洋溫差以及洋流（current）發電，其優缺點如何？