คณะวิศวกรรมศาสตร์

มหาวิทยาลัยสงขลานครินทร์

การสอบปลายภาคการศึกษาที่ **1** ปีการศึกษา **2546**

วันพฤหัสบดีที่ **9** ตุลาคม **2546** เวลา **: 13.30-16.30 น.**

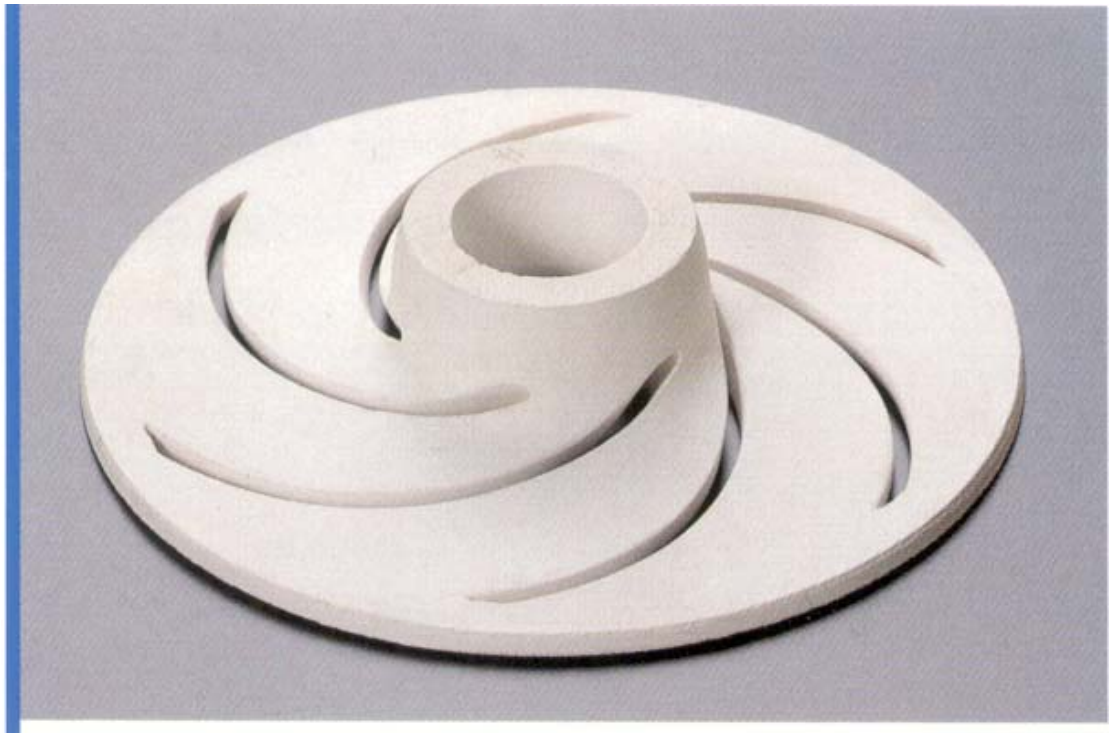
วิชา **: 237-341 : Ceramic Processes** ห้อง **: R 300**

Please mention : 1. Write the answer in this paper
2. Open books examination

Name……Code……

1. This is a pump part made of silicon nitride which has an excellent smooth surface texture, and saves time for the final finishing stage. (30 points)
   1.1 Which method do you select to fabricate it ?
   1.2 Explain in detail how to make mould, how to control the processing parameters, for instances, in case of a slip casting method, you should mention how to control a slurry rheology, consistency and density etc.
   1.3 Give the formulation of raw materials and additives used, and how to synthesized the silicon nitride.
   1.4 Explain the flow chart of the process selected.
   1.5 Express the conditions which control each procedure of the selected process.
   1.6 Indicate the effect of pressure, temperature and microstructure on the process and the product.

Name.....Code.....



Name.....Code.....

Name.....Code.....

Name.....Code.....

2. This is an alumina part used for high frequency applications. (20 points)
   2.1 Select the method to fabricate this product.
   2.2 Give detail in raw material preconsolidation, forming parameter and technique, drying, densification or firing and finishing.
   2.3 Express the defects will occur by this method and how to overcome the problems.
   2.4 Explain the role of % shrinkage on the process.

Name.....Code.....

Name.....Code.....

Name.....Code.....

3. Explain : (15 points)
   3.1 Gel casting process

   3.2 Spray drying process

Name.....Code.....

3.3 Dry isostatic pressing

4. Select one of ceramic processing machines and explain the principle and operating procedure. (10 points)

Name.....Code.....

5. Please tick √ or **X** in front of the following expressions. (15 points)

_____5.1 The completeness of the reaction and uniformity of the product depend on the particle size and mixedness of the reactants only.

_____ 5.2 The ratio of the area shape factor to volume shape factor of sphere is $\frac{\pi}{6}$

_____ 5.3 If the porous fragment has mass of 20 grams, total volume of 20 cubic centimeters and an opened porosity of 0.6 cubic centimeters, the apparent density is 1.03 Mg/m^3

_____5.4 If point of zero charge of kaolin is pH 6-7, kaolin will be deflocculated by increasing pH value.

_____ 5.5 Usually, the surface charge of silica particle is a positive charge.

_____5.6 Steric hindrance produces deflocculation of particles in polar liquids.

_____5.7 Gelation in a binder solution increases the cohesive strength and viscosity of the system.

_____5.8 In practice, the maximum packing fraction is achieved when the ratio between nearest sizes is greater than about 10 and the finer particles are dispersed uniformly.

_____5.9 Rough surfaces and adsorbed molecules which prevent motion reduce flowability of granules.

_____5.10 The consistency state of the ceramic raw material for fabricating by extrusion method is in a paste form.

_____ 5.11 Spring back is much occurred when a rubbery binder is used.

_____ 5.12 The compressive strength of a granule and tensile strength of a compact depend on the PF of the particles, volume and strength of binder.

_____ 5.13 Most casting slip behaves as Newtonian material.

_____ 5.14 Vibration mill has a higher efficiency than a ball mill.

_____ 5.15 On discharging dry material from a bin, funnel flow is not acceptable for coarse materials.

6. **Bonus** : Give the techniques to make porous ceramic body.

Good luck!
Associate Prof. Dr. Lek Sikong