

Appendix 1: Survey on Discussion-based Teaching in Small Class for Graduate Students in Engineering

1. What do you think is the impact of small class discussion teaching on improving graduate student learning motivation and learning outcomes
 - A. Significant positive impact
 - B. Has a certain positive impact
 - C. No significant impact
 - D. Other
2. Have you ever received small class discussion teaching? How does this teaching method help your learning?
 - A. Yes, it is helpful for learning
 - B. Yes, no obvious help
 - C. No
3. Do you think small class discussion teaching can help cultivate graduate students' engineering thinking abilities?
 - A. Yes
 - B. No, it's not
 - C. Uncertain
4. Have you ever taken a small personalized online course? Which method do you think is more advantageous compared to traditional classroom learning?
 - A. Yes, online courses have more advantages
 - B. Yes, traditional classrooms have more advantages
 - C. No
5. Do you think flipped classroom can improve the learning effectiveness of graduate students?
 - A. Yes
 - B. No, it's not
 - C. Uncertain
6. What do you think is the important role of teacher support and guidance in student learning in small class discussion teaching?
 - A. Very important
 - B. Generally important
 - C. Not very important
7. Have you ever experienced academic emotional fluctuations? Do you think there is a correlation between learning motivation and emotions?
 - A. Having experienced it, there is a connection
 - B. Experienced, unrelated
 - C. Not experienced before
8. What aspects of support do you think graduate students in the field of instrumentation need the most

in the learning process?

- A. Academic guidance support
- B. Emotional support
- C. Will support
- D. Other

9. Do you think that classroom teaching for graduate students should focus more on developing student autonomy or technical skills?

- A. Developing autonomy
- B. Emphasize technical aspects
- C. Balanced development

10. Do you think small class discussion based teaching can help graduate students establish clear future goals?

- A. Definitely
- B. Maybe
- C. Not very likely

11. Do you think small class discussion based teaching can help graduate students better cope with challenges and solve problems? Why?

- A. Definitely
- B. Maybe
- C. Not very likely

12. During your graduate studies, have you experienced any improvement in your academic research abilities and engineering thinking?

- A. Yes, I have experienced it before
- B. No

13. Do you prefer to passively receive knowledge or actively participate in discussions in the classroom? Please explain the reason.

- A. Tendency to passively accept knowledge
- B. Tend to actively participate in discussions

14. Which teaching method do you prefer: small class discussion teaching or traditional large class teaching? Why?

- A. Small class discussion based teaching
- B. Traditional large class teaching

15. How do you think flipped classroom is helpful for improving graduate students' self-directed learning ability?

- A. Helpful
- B. No help

16. How important do you think the ability to think independently and solve problems is for the development of graduate students?

- A. Very important
- B. Generally important

C. Not very important

17. What is your opinion on the learning methods of small personalized online courses? How do you think this affects the learning motivation of graduate students?

A. Positive perspectives can enhance learning motivation

B. Negative views with no significant impact

18. How do you think teachers should motivate graduate students to learn and improve their learning outcomes?

A. Provide more support and coaching

B. Promoting self-directed learning among students

C. Develop incentive mechanisms

19. Have you experienced fluctuations in learning motivation during your graduate studies? How did you respond?

A. Having experienced

B. Not experienced before

20. How do you think the academic community should promote the popularization and application of small class discussion teaching in graduate education in the future?

A. Increase investment support

B. Advocate for the popularization of ideas

C. Other

Appendix 2: A Case Study of Achievement Test in Small Class Discussion Teaching of Sensor Principles and Applications for Graduate Students

Instruction: This test consists of multiple multiple-choice questions and question and answer calculation questions; Multiple choice questions require selecting the option that best fits the meaning of the question. Calculation or question answering questions require answering according to the requirements of the question, with a duration of 1 hour.

1. In the measurement circuit used for resistance strain gauges, in order to overcome the influence of distributed capacitance, it is often used _____.(5 points)

A) DC balanced bridge

B) DC unbalanced bridge

C) AC flat bridge

D) AC Uneven Bridge

2. It is known that the excitation current of a certain Hall sensor is $I=5A$, the magnetic induction intensity of the magnetic field is $B=5 \times 10T$, the thickness of the conductor sheet is $d=2mm$, and the Hall constant is $R=0.8$, the Hall potential U_r generated by the thin conductor is _____.(5 points)

A) 20V

- B) 10V
- C) 100V

3. Nonlinearity represents the calibration curve _____.(5 points)

- A) is close to the true value.
- B) Deviation from fitting straight line.
- C) The forward and reverse strokes do not coincide.

4. Solid state semiconductor camera element CCD is a type of _____.(5 points)

- A) PN junction photodiode circuit.
- B) PNP type transistor integrated circuit.
- C) MOS transistor switch integrated circuit.
- D) NPN type transistor integrated circuit.

5. Which of the following indicators of sensors do not belong to static characteristics _____.(5 points)

- A Linearity
- B. Frequency response
- C score

6. Use an eddy current speed sensor to measure the shaft speed. When the shaft speed is 50r/min, the frequency of the induced electromotive force output is 50Hz, measure the number of teeth on the gear as _____.(5 points)

- A) 60
- B) 120
- C) 180
- D) 240

7. To evaluate the measurement accuracy of different measured and physical quantities, it is necessary to use _____.(5 points)

To assess more accurately

- A) Absolute error
- B) relative error
- C) Citation error
- D) System error

8. The resistance of metal conductors increases with temperature _____.(5 points)

- A) large
- B) Reduce size
- C) Invariant
- D) Unable to determine

9. Which of the following indicators of sensors do not belong to static characteristics (5 points)

- A) Linearity
- B) frequency response

C) resolution

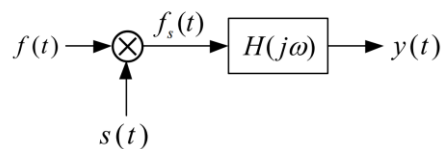
10. What are the reasons for interference during signal transmission (5 points)

- A) signal is slowly changing
- B) signal is rapidly changing
- C) Interference coupling channel
- D) letter communication

11. In the system shown in Figure 1, $f(t) = Sa^2(\pi t)$, $s(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$, $H(j\omega) =$

$$0.4[\varepsilon(\omega + \omega_c) - \varepsilon(\omega - \omega_c)],$$

- (1) If you want to start from $F_s(t)$ recovered from signal $f(t)$, What are the requirements for T_s and ω_c ? (10 points)
- (2) Draw the spectrum of signals $F_s(t)$ and $\omega_c = \pi$ at $T_s = 0.4$ radians/second. (10 points)



12. 10 analog signals with frequency band limitations within $(0, f_H)$, sample each signal separately, and time divide. After reuse, quantization and encoding are performed. It is known that A-law 13 line encoding is applied to each sampled value. After passing through the raised cosine filter of $\alpha = 0.25$ without intersymbol interference transmission, the cut-off frequency of the raised cosine baseband system is 75000 Hz.

- (1) Calculate the maximum symbol transmission rate of the system; (2 points)
- (2) Calculate the maximum frequency component allowed for each analog signal. (3 points)
- (3) If using BPSK for transmission, calculate the required transmission bandwidth. (5 points)